

ELECTRONIC RECORDS ARCHIVES

METRICS PLAN (MP)

(TOMP Version 2.0, Task 4.3.2)

for the

**NATIONAL ARCHIVES AND
RECORDS ADMINISTRATION**

**ELECTRONIC RECORDS ARCHIVES
PROGRAM MANAGEMENT OFFICE
(NARA ERA PMO)**

Final

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ERA METRICS PLAN (MP)

Signature Page

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ERA Metrics Plan

1.0 Introduction

This section describes the purpose of the Metrics Plan (MP), provides background information on the program, scope including assumptions and limitations, defines terminology used in the plan, and lists documents used as reference materials during plan development.

1.1 Purpose

The MP is a program level document and its purpose is to plan metrics activities for the Electronic Records Archives (ERA) Program for use throughout the ERA system acquisition and development life cycle phases. It describes the schedules, functions, responsibilities, and procedures for all metrics activities within ERA.

The audience for this document is the ERA Program Management Office (PMO), as well as NARA management responsible for oversight of ERA and the systems integrator hired to develop ERA. The collected metrics provide insight into the achievement of the ERA vision through completion of program activities. Additionally, the metrics provide input to NARA's technical, quality, and product performance goals as described in *The Strategic Plan of the National Archives and Records Administration* and the *Annual Performance Plan*.

1.2 ERA Program Overview

ERA will be a comprehensive, systematic, and dynamic means for preserving virtually any kind of electronic record, free from dependence on any specific hardware or software. The ERA, when operational, will make it easy for NARA customers to find records they want and easy for NARA to deliver those records in formats suited to customers' needs. The success of the ERA PMO in building and deploying the ERA system will depend on professional program and project management with an emphasis on satisfying NARA requirements for a viable system.

1.3 Scope

Metrics provide visibility to the status and ongoing progress of the ERA program. Currently, metrics to be collected are identified up through and including the Acquisition and Supply, and Development phases of the ERA systems development life cycle. The ERA PMO uses metrics to track the size, effort, budget, and schedule of the ERA program. The Metrics Plan provides the following:

- Definition and usage of the metrics;
- Identification of the roles and responsibilities for metrics collection, reporting, storage, and tracking processes; and
- Procedures, tools, and resources required for metrics collection and reporting.

This plan applies to all ERA metrics. Metrics required to be collected by the ERA PMO are documented in this plan. Metrics required by the Development Contractor are also provided in this document. Additionally, a Development Contractor may choose to develop additional

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metrics to complement the identified metrics, but must comply with the reporting requirements described in this plan.

All metrics must adhere to the following characteristics of software life cycle data as defined in IEEE/EIA 12207.1-1997, *Standard for Information Technology – Software life cycle processes – Implementation Considerations*.

- Unambiguous: Data is described in terms that only allow a single interpretation.
- Complete: Data includes necessary, relevant requirements with defined units of measure.
- Verifiable: A person or a tool can check the data for accuracy or correctness.
- Consistent: There are no conflicts within the data.
- Traceable: The origin of the data can be determined.
- Presentable: The data can be retrieved and viewed.

1.3.1 Assumptions

The ability to manage metrics assumes the following:

- Tools used by Development Contractors will be compatible with those used by the ERA PMO,
- Earned Value metrics will be submitted on a biweekly basis, and
- All other metrics will be submitted on a monthly basis.

1.3.2 Limitations

There are no known limitations at this time.

1.4 Acronyms and Definitions

The terms used in this plan are defined in IEEE Std 610.12-1990, *IEEE Standard Glossary of Software Engineering Terminology*. **Table 1-1, Acronyms List**, contains a list of acronyms used herein.

ACRONYM	DEFINITION
AC	Actual Cost
AI	Action Item
AS	Acquisition Strategy
BAC	Budget At Completion
CCB	Configuration Control Board
CI	Configuration Item
CM	Configuration Management
CMG	Configuration Management Guidance
CMP	Configuration Management Plan
CONOPS	Concept of Operations

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ACRONYM	DEFINITION
COTS	Commercial Off-The-Shelf
CP	Communications Plan
CPI	Cost Performance Index
CR	Change Request
CV	Cost Variance
EAC	Estimate At Completion
ELC	ERA Life Cycle
ERA	Electronic Records Archives
ETC	Estimate To Complete
EV	Earned Value
EVMS	Earned Value Management System
GQM	Goal-Question-Metric
IEEE	Institute of Electrical and Electronics Engineers, Inc.
IPT	Integrated Product Team
IT	Information Technology
IV&V	Independent Verification and Validation
LOE	Level Of Effort
MP	Metrics Plan
MR	Metrics Report
MRP	Metrics Report Process
NARA	National Archives and Records Administration
PD	Program Director
PMBOK	Project Management Body of Knowledge
PMD	Program Management Division
PMI	Project Managements Institute
PMO	Program Management Office
PMP	Program Management Plan
PO	Program Office
POST	Program Office Support Team
PRP	Peer Review Process
PV	Planned Value
QM	Quality Management
QMP	Quality Management Plan
RKG	Risk Management Guidance
RKM	Risk Management Plan
RO	Risk Officer
RQM	Requirements Management Plan
SDLC	Systems Development Life Cycle
SED	System Engineering Division
SLIM	Software Lifecycle Management
SLOC	Software Lines of Code
SPI	Schedule Performance Index

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ACRONYM	DEFINITION
STD	Standard
SV	Schedule Variance
TAB	Total Allocated Budget
TCPI	To Complete Performance Index
TRA	Training Needs Assessment
TRP	PMO Training Plan
TSP	Testing Management Plan
VAC	Variance At Completion
VAR	Variance Analysis Report
WBS	Work Breakdown Structure

Table 1-1: Acronyms List

1.5 References

The standards, guidelines, and documentation used to develop the MP are described in the sections that follow.

1.5.1 Standards and Guidelines

The standards and guidelines used in preparation of this document are listed below.

- American National Standards Institute (ANSI) 748-A.
- IEEE/EIA Guide, Industry Implementation of International Standard ISO/IEC 12207:1995 (ISO/IEC 12207), Standard for Information Technology – Software life cycle processes – Implementation Considerations, April 1998;
- IEEE/EIA Guide, Industry Implementation of International Standard ISO/IEC 12207:1995 (ISO/IEC 12207), Standard for Information Technology – Software life cycle processes – Life cycle data, April 1998;
- IEEE Standard 1061-1998, Software Quality Metrics Methodology; December 8, 1998;
- IEEE Standard for Software Productivity Metrics, Software Engineering Standards Subcommittee of the Technical Committee on Software Engineering of the IEEE Computer Society, March 22, 1993; and
- Government Performance and Results Act of 1993 (GPRA)
- Project Management Institutes (PMI) Project Management Body of Knowledge (PMBOK) 2000 Edition

1.5.2 NARA and ERA PMO Documentation

The following NARA and ERA PMO documentation was used to support the generation of this document.

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- Configuration Management Plan (CMP) Version 1.5
- Fiscal Year 2002 Annual Performance Plan, Revised Final
- Fiscal Year 2003 Annual Performance Plan, Submitted to the Congress February 4, 2002;
- Metrics Report (MR)
- Metrics Report Process (MRP) Version 1.0
- Peer Review Process (PRP) Version 1.1
- Program Management Plan (PMP) Version 1.2
- Quality Management Plan (QMP) Version 2.0
- Requirements Management Plan (RQM) Version 1.3
- Risk Management Plan (RKM) Version 1.0
- Testing Management Plan (TSP) Version 2.1
- The Strategic Plan of the National Archives and Records Administration 1997 – 2007
- Training Needs Assessment (TRA) Version 2.0
- PMO Training Plan (TRP) Version 1.0

2.0 Organization

The ERA PMO Metrics Organization consists of representatives from the ERA PMO in each of the following roles:

- Program Director (PD),
- Metrics Task Leader,
- Configuration Management (CM) Specialist,
- Development Contractors,
- Financial Analyst,
- IPT Chairs,
- Program Control,
- Quality Management (QM) Specialist,
- Requirements Officer,
- Risk Officer,
- Senior Systems Engineer, and
- Testing Officer.

Figure 2-1, PMO Metrics Organization Chart, defines the organizational chart and categories of personnel who participate in the metrics management process.

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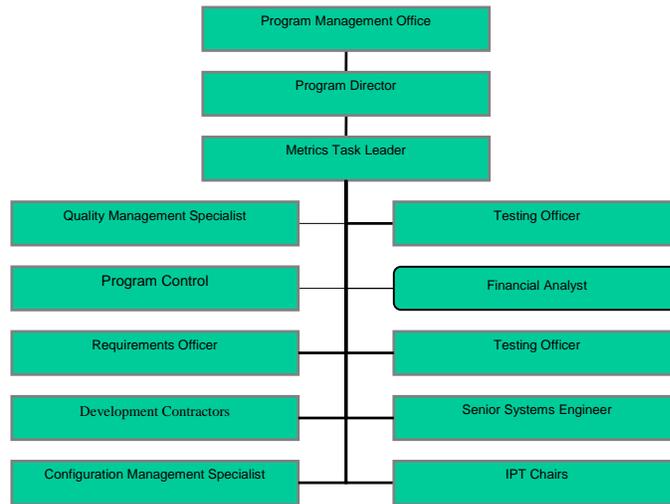


Figure 2-1: PMO Metrics Organization

2.1 Roles and Responsibilities

The ultimate responsibility for ERA’s metrics program rests with the Program Director (PD). The day-to-day management is delegated to the Metrics Task Leader to ensure that metrics collection occurs and reports are generated for the PD. **Table 2-1, PMO Organization Roles and Responsibilities**, provides a synopsis of the primary responsibilities for the various aspects of metrics management.

Roles	Responsibilities
Program Director	The PD uses the metrics data to evaluate program status and understand program risks and problems. The metrics data helps the PD to answer the questions such as: <ul style="list-style-type: none"> • What is the current status of the ERA program? • Is the program on track to complete within cost, schedule, and performance criteria? • What is the status of previously identified risks? • What is the status of corrective actions to eliminate problems or mitigate risk?
CM Specialist	The CM Specialist is responsible for ensuring that the metrics for configuration management as defined by this plan, e.g., CM Rate of Change, and Change Request Inventory, are collected and tracked.

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Roles	Responsibilities
Development Contractor(s)	The Development Contractor is responsible for providing metrics data, as defined by this plan, for each ERA life cycle process under which contracted services are provided to NARA. The Development Contractor is responsible for the collection and tracking of all metrics related to the system development effort under the ERA Development process. The Development Contractor is encouraged to suggest additional metrics, which may provide more detailed indicators of program status.
Financial Analyst	The Financial Analyst is responsible for the collection and tracking of metrics related to the ERA program schedule, resources, and budget.
IPT Chairs	Each Integrated Product Team (IPT) Chair is responsible for the collection and tracking of designated metrics for the defined product or process of their IPT. See the <i>Program Management Plan (PMP)</i> for specific descriptions of individual IPTs.
Metrics Task Leader	The Metrics Task Leader, a member of the Systems Engineering Division, is responsible for the definition, collection, storage, and reporting of all ERA metrics. Responsibilities include providing training to ERA team members on the metrics collection processes and ensuring that metrics reports are generated for the PD on a regular basis.
Program Control	A member of the Program Management Division who is responsible for schedule adherence, schedule management, Work Breakdown Structure, resource allocations and program performance metrics.
QM Specialist	<p>The QM Specialist is responsible for the collection and tracking of metrics for the quality assurance and quality control and activities itself, e.g., peer review completion rate, and action items aging. Additionally, the QM Specialist must:</p> <ul style="list-style-type: none"> • Ensure, through the audit and review processes, that all components of the ERA program provide their metrics data according to this plan • Verify that the measurement process is followed through the completion of audits
Requirements Officer	The Requirements Officer works with the Testing Officer to ensure that requirements can be traced through the development, design, and test phases of the systems development life cycle, and to ensure that requirements have been tested.

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Roles	Responsibilities
Risk Officer	The ERA Risk Officer (RO) and Risk Officer for each IPT is responsible for the collection and tracking of metrics data for risk management. Metrics to be reported are the number of high, moderate, or low risk items. More detailed risk information and the reporting of that information is provided in the <i>ERA Risk Management Plan</i> . The IPT establishes metrics to measure the effectiveness of the planned risk mitigation strategy for each identified risk. Additional information regarding the role of the Risk Officer for IPTs is provided in an appendix of the <i>ERA Risk Management Plan</i> .
Senior Systems Engineer	The Senior Systems Engineer is responsible for the collection and tracking of metrics for product development and delivery under the ERA life cycle processes.
Testing Officer	The Testing Officer is responsible for the collection and tracking of metrics during the implementation of the testing processes and execution of test procedures during the various phases of testing.

Table 2-1: PMO Organization Roles and Responsibilities

2.2 Schedule/Incremental Approach

The source selection process is in its early stages. The acquisition strategy calls for two vendors to compete in a design fly-off that will result in a down-select to a single Development Contractor. That Development Contractor will be awarded an option to develop ERA Increment 1. Options for subsequent increments will be awarded subject to availability of funding and adequate Development Contractor performance on the preceding increment.

2.3 Planned Tasks and Activities

The metric task is identified in the *ERA Program Management Plan (PMP)*. Metrics activities comprising this task, including the collection, storage, and reporting of metrics using the *ERA Metrics Report (MR)*, are identified and scheduled in accordance with the ERA Work Breakdown Structure (WBS) and Schedule, which is controlled as part of the *ERA PMP*.

EVMS metrics will be collected and reported on a biweekly basis while all other metrics will be collected and reported on a monthly basis in the *ERA Metrics Report (MR)* for the system development life cycle phases as defined in the *IEEE/EIA Guide, Industry Implementation of International Standard ISO/IEC 12207:1995 (ISO/IEC 12207), Standard for Information Technology – Software life cycle processes – Life cycle data* document.

2.4 Task Estimation and Cost

The Work Breakdown Structure and Schedule, part of the *ERA PMP* delineates metrics activities/tasks. Please refer to this document for more detailed information.

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3.0 Metrics Collection and Use

This section provides details regarding metrics definition, collection, and reporting. Application of the measurement approach provides all program stakeholders with a common and quantitative means to monitor risk and program success in a timeframe that avoids or minimizes program impacts and the cost of correction.

Section 3.1 defines the methodology used to determine the metrics generated for the ERA PMO and Development Contractor during the Acquisition, Supply, and Development phases of the systems development life cycle. All metrics, particularly metrics captured beyond the Acquisition, Supply, and Development phases of the systems development life cycle, are subject to periodic review and update as program activities are completed. Descriptions, definitions of data items, computations, additional data, and examples of each metric are provided in **Appendix A, ERA PMO Metrics Definitions**, and **Appendix B, ERA Development Contractor Metrics Definitions**.

Section 3.2 provides the detailed collection and storage procedures for the metrics as well as the reporting requirements.

3.1 Metrics Definition

The MP defines a set of metrics that provide insight to system quality and productivity as well as product characteristics and program management. The plan helps the PD monitor the status of the ERA program from a quantitative perspective, and make programmatic decisions based on the metric information presented in the monthly *ERA Metrics Report (MR)*. **Note that any metric in isolation is not sufficient to determine program status. A set of metrics and their trends is usually needed to make a judgment.** When a metric such as “Requirements Coverage” indicates unacceptable coverage of requirements for a given reporting period, the responsible ERA PMO Metrics Organization member may evaluate certain other measures in order to isolate the specific cause(s) of the problem. In this way, the corrective action taken addresses the actual problem not just the symptoms. The key to successful use of the metrics defined in this plan is the frequency of reporting and data analysis.

In trying to determine what to measure in order to achieve the goals of the ERA program, the Goal-Question-Metric (GQM) paradigm was used. **Figure 3-1, Goal-Question-Metric Paradigm** illustrates the relationship of the GQM components.

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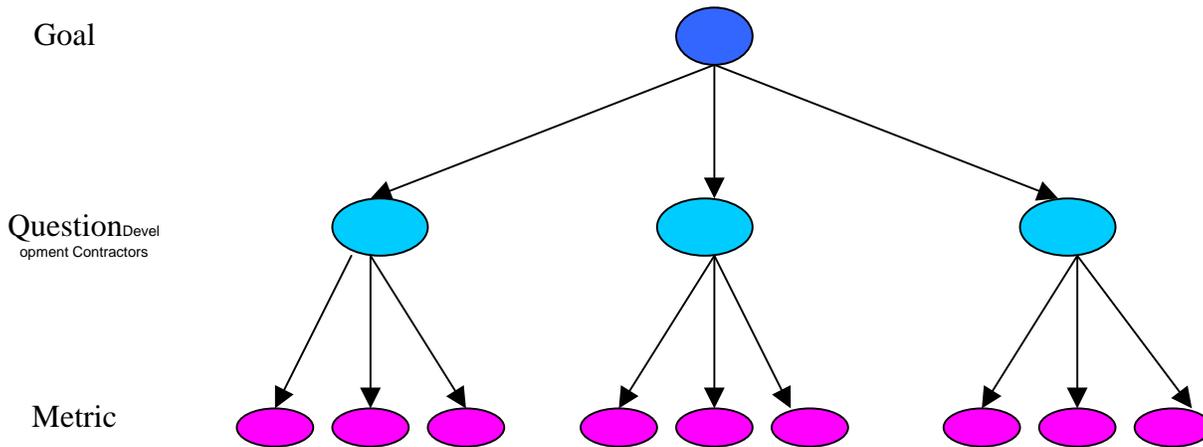


Figure 3-1 Goal-Question-Metric Paradigm

The GQM paradigm is based on the theory that all measurement should be goal-oriented, i.e., there has to be some rationale for collecting measurements, i.e., there is no need to collect metrics just to collect metrics. Each metric collected is stated in terms of the major goals of the ERA development project. Questions are then derived from the goals and help to refine, articulate, and determine if the goals can be achieved. The metrics or measurements that are collected are then used to answer the questions in a quantifiable manner.

3.1.1 Metrics Sets

The sections below list the metrics to be collected by the ERA PMO and Development Contractor(s).

3.1.2 ERA PMO Metrics

ERA PMO specific metrics will be collected on a monthly basis during the Acquisition, Supply, and Development phases of the systems development life cycle. Metrics to be collected and reported for the ERA PMO include the following:

- Action Item Aging,
- Change Request Inventory,
- CM Rate of Change,
- Cumulative Actual Monthly Cost,
- Earned Value Management System that includes:
 - Estimate At Completion,
 - Estimate To Complete,
 - Cost Performance Index,
 - Schedule Performance Index,

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- Cost Variance/Cost Variance Percentage,
- Schedule Variance/Schedule Variance Percentage,
- Variance at Completion,
- Level of Effort, and
- To Complete Performance Index,
- Milestone Completion Summary,
- Peer Reviews Completed,
- Program Staffing Profile,
- Risk Containment Summary, and
- Work Products Completion Summary.

Each metric to be generated, including the required data items, is provided in **Table 3-1, ERA PMO Metric Data Items.**

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										Metrics								
										EVMS								
Data Items	Action Item Aging	Change Request Inventory	CM Rate of Change	Cumulative Actual Monthly Cost	Cost Performance Index	Cost Variance or Cost Variance %	Estimate At Completion	Estimate To Complete	Level of Effort	Schedule Performance Index	Schedule Variance or Schedule Variance %	To Complete Performance Index	Variance At Completion	Milestone Completion Summary	Peer Reviews Completed	Program Staffing Profile	Risk Containment Summary	Work Products Completion Summary
Number of Action Items as of the end of the reporting period	X																	
Total Number of Action Items Cumulative	X																	
Number of Action Items Open as of the end of the reporting period	X																	
Number of Action Items Open by Severity as of the end of the Reporting Period	X																	
Total Number of Action Items by Severity Cumulative	X																	
Total Number of Action Items Closed as of the end of the reporting period	X																	
Total Number of Action Items Closed Cumulative	X																	

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										Metrics								
										EVMS								
Data Items	Action Item Aging	Change Request Inventory	CM Rate of Change	Cumulative Actual Monthly Cost	Cost Performance Index	Cost Variance or Cost Variance %	Estimate At Completion	Estimate To Complete	Level of Effort	Schedule Performance Index	Schedule Variance or Schedule Variance %	To Complete Performance Index	Variance At Completion	Milestone Completion Summary	Peer Reviews Completed	Program Staffing Profile	Risk Containment Summary	Work Products Completion Summary
Number of Action Items Closed by Severity as of the end of the reporting period	x																	
Total Number of Action Items Closed by Severity Cumulative	x																	
Action Item Aging	x																	
Average Time Taken to Close Action Items	x																	
Total Time Taken to Close Action Items	x																	
Total Number of Action Items Open per Severity and Time Interval: <ul style="list-style-type: none"> • 0 – 30 days, • 31– 60 days, • 61– 90 days, and • > 90 days 	x																	
Total Number of Change Requests Submitted		x																
Cumulative Number of Change Requests Submitted		x																

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									Metrics									
									EVMS									
Data Items	Action Item Aging	Change Request Inventory	CM Rate of Change	Cumulative Actual Monthly Cost	Cost Performance Index	Cost Variance or Cost Variance %	Estimate At Completion	Estimate To Complete	Level of Effort	Schedule Performance Index	Schedule Variance or Schedule Variance %	To Complete Performance Index	Variance At Completion	Milestone Completion Summary	Peer Reviews Completed	Program Staffing Profile	Risk Containment Summary	Work Products Completion Summary
Total Number of Change Requests Approved		x																
Cumulative Number of Change Requests Approved		x																
Total Number of Change Requests Submitted by Type of Change: <ul style="list-style-type: none"> • Document, • Hardware, • Software <ul style="list-style-type: none"> - Developed - COTS • Requirements 		x																
Cumulative Number of Change Requests Submitted by Type of Change		x																
Total Number of Change Requests Approved by Type of Change		x																

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									Metrics									
									EVMS									
Data Items	Action Item Aging	Change Request Inventory	CM Rate of Change	Cumulative Actual Monthly Cost	Cost Performance Index	Cost Variance or Cost Variance %	Estimate At Completion	Estimate To Complete	Level of Effort	Schedule Performance Index	Schedule Variance or Schedule Variance %	To Complete Performance Index	Variance At Completion	Milestone Completion Summary	Peer Reviews Completed	Program Staffing Profile	Risk Containment Summary	Work Products Completion Summary
Cumulative Number of Change Requests Approved by Type of Change		x																
Total Number of Change Requests Submitted by Priority Level		x																
Cumulative Number of Change Requests Submitted by Priority Level		x																
Total Number of Change Requests Approved by Priority Level		x																
Cumulative Number of Change Requests Approved by Priority Level		x																
Total Number of Change Requests Disapproved		x																
Cumulative Number of Change Requests Disapproved		x																

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									Metrics									
									EVMS									
Data Items	Action Item Aging	Change Request Inventory	CM Rate of Change	Cumulative Actual Monthly Cost	Cost Performance Index	Cost Variance or Cost Variance %	Estimate At Completion	Estimate To Complete	Level of Effort	Schedule Performance Index	Schedule Variance or Schedule Variance %	To Complete Performance Index	Variance At Completion	Milestone Completion Summary	Peer Reviews Completed	Program Staffing Profile	Risk Containment Summary	Work Products Completion Summary
Total Number of Change Requests Disapproved by Priority Level		X																
Cumulative Number of Change Requests Disapproved by Priority Level		X																
Total Number of Change Requests Disapproved by Type of Change		X																
Cumulative Number of Change Requests Disapproved by Type of Change		X																
Total Number of Change Requests Open		X																
Total Number of Change Requests Open by Type of Change		X																
Total Number of Change Requests Open by Priority		X																
Cumulative Number of Change Requests Open		X																

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									Metrics									
									EVMS									
Data Items	Action Item Aging	Change Request Inventory	CM Rate of Change	Cumulative Actual Monthly Cost	Cost Performance Index	Cost Variance or Cost Variance %	Estimate At Completion	Estimate To Complete	Level of Effort	Schedule Performance Index	Schedule Variance or Schedule Variance %	To Complete Performance Index	Variance At Completion	Milestone Completion Summary	Peer Reviews Completed	Program Staffing Profile	Risk Containment Summary	Work Products Completion Summary
Cumulative Number of Change Requests Open by Type of Change		X																
Cumulative Number of Change Requests Open by Priority		X																
Total Number of Configuration Items			X															
Total Number of Modified Configuration Items			X															
Original Budget Estimate				X														
Outlays				X														
Obligations				X														
Actual Cost (AC)					X	X	X	X				X	X					
Budget At Completion (BAC)							X	X				X	X					
Earned Value (EV)					X	X	X	X		X	X	X	X					
Planned Value (PV)										X	X							
Cumulative Budgeted Labor Hours									X									
Total Budgeted Labor Hours									X									

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									Metrics									
									EVMS									
Data Items	Action Item Aging	Change Request Inventory	CM Rate of Change	Cumulative Actual Monthly Cost	Cost Performance Index	Cost Variance or Cost Variance %	Estimate At Completion	Estimate To Complete	Level of Effort	Schedule Performance Index	Schedule Variance or Schedule Variance %	To Complete Performance Index	Variance At Completion	Milestone Completion Summary	Peer Reviews Completed	Program Staffing Profile	Risk Containment Summary	Work Products Completion Summary
Cumulative Actual Labor Hours									X									
Tasks (as identified in WBS)									X									
Number of Scheduled Milestones (Cumulative)														X				
Number of Completed Milestones (Cumulative)														X				
Number of Peer Reviews Scheduled (Cumulative)															X			
Number of Peer Reviews Completed (Cumulative)															X			
Number of Projected ERA Staff																X		
Actual Number of ERA Staff																X		
Number of Projected Government Staff																X		
Number of Actual Government Staff																X		
Number of Projected POST Staff																X		
Actual Number of POST Staff																X		

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									Metrics									
									EVMS									
Data Items	Action Item Aging	Change Request Inventory	CM Rate of Change	Cumulative Actual Monthly Cost	Cost Performance Index	Cost Variance or Cost Variance %	Estimate At Completion	Estimate To Complete	Level of Effort	Schedule Performance Index	Schedule Variance or Schedule Variance %	To Complete Performance Index	Variance At Completion	Milestone Completion Summary	Peer Reviews Completed	Program Staffing Profile	Risk Containment Summary	Work Products Completion Summary
Number of Projected Government Staff by Division: <ul style="list-style-type: none"> PMO Total, PMO PO, PMO PMD, and PMO SED 																X		
Number of Actual Government Staff by Division: <ul style="list-style-type: none"> PMO Total, PMO PO, PMO PMD, and PMO SED 																X		
Number of Projected POST Staff by Division: <ul style="list-style-type: none"> POST Total, POST PO, POST PMD, and POST SED 																X		

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									Metrics									
									EVMS									
Data Items	Action Item Aging	Change Request Inventory	CM Rate of Change	Cumulative Actual Monthly Cost	Cost Performance Index	Cost Variance or Cost Variance %	Estimate At Completion	Estimate To Complete	Level of Effort	Schedule Performance Index	Schedule Variance or Schedule Variance %	To Complete Performance Index	Variance At Completion	Milestone Completion Summary	Peer Reviews Completed	Program Staffing Profile	Risk Containment Summary	Work Products Completion Summary
Number of Actual POST Staff by Division: <ul style="list-style-type: none"> • POST Total, • POST PO, • POST PMD, and • POST SED 																X		
Cumulative Number of Open Risk Items																		X
Cumulative Number of Open Risk Items by Risk Exposure: <ul style="list-style-type: none"> • High, • Moderate, and • Low 																		X
Cumulative Number of Closed Risk Items																		X
Cumulative Number of Closed Risk Items by Risk Exposure																		X
Number of Scheduled Work Products (Cumulative)																		X

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		Metrics	EVMS
		↑	↓
		↓	↑
Data Items			
	Action Item Aging		
	Change Request Inventory		
	CM Rate of Change		
	Cumulative Actual Monthly Cost		
	Cost Performance Index		↓
	Cost Variance or Cost Variance %		
	Estimate At Completion		
	Estimate To Complete		
	Level of Effort		EVMS
	Schedule Performance Index		
	Schedule Variance or Schedule Variance %		
	To Complete Performance Index		
	Variance At Completion		
	Milestone Completion Summary		
	Peer Reviews Completed		
	Program Staffing Profile		
	Risk Containment Summary		
Number of Completed Work Products (Cumulative)			
	Work Products Completion Summary		X

Table 3-1: ERA PMO Metrics Data Items

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3.1.3 ERA Development Contractor Metrics

Metrics to be collected and reported on a monthly basis by the Development Contractor during the Development Phase of the systems development life cycle include the following:

- Action Item Aging,
- Change Request Inventory,
- Defect Management,
- Earned Value Management System that includes:
 - Cost Performance Index,
 - Cost Variance/Cost Variance Percentage,
 - Estimate At Completion
 - Estimate To Complete,
 - Level of Effort,
 - Schedule Performance Index,
 - Schedule Variance/Schedule Variance Percentage,
 - To Complete Performance Index, and
 - Variance At Completion,
- Risk Containment Summary,
- Software Size, and
- Test Coverage.

Each metric to be generated, including the required data items, is provided in **Table 3-2, Development Contractor Metric Data Items.**

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3.2 Metrics Environment Infrastructure

The sections below describe the metrics collection, reporting, and storage requirements.

3.2.1 Metrics Collection

Various ERA PMO Metric Organization team members are responsible for ensuring that metrics data is collected and reported in a timely manner. **Table 2-1, ERA Organization Roles and Responsibilities**, in **Section 2**, lists team member responsibilities. In some cases, this effort requires using tools to extract the metrics data from a database at the appropriate time. Other data, e.g., number of configuration item changes, is compiled manually. The data source used to collect the data is provided in the metrics tables in **Appendices A and B**. Note that where possible, data is extracted automatically from other sources. The collection and reporting for subsequent ERA phases will be defined in a later version of the *ERA MP*.

3.2.2 Metrics Reporting

The metric data that is collected will be used to generate the *ERA Monthly Metrics Report*. The metric data to be used will be as of the end of the reporting period, i.e., end of the calendar month. The *ERA Metrics Report Process (MRP)* document describes the report generation process.

3.2.3 Metrics Storage

Metrics data is stored in the ERA common repository on the shared drive.

4.0 Resources

This section describes the ERA PMO metric resource requirements that will be used during the course of the ERA system development life cycle.

4.1 Resources for Metrics

The resources needed for metrics are those provided by the ERA PMO to collect, enter, and validate the data and provide the reports. For the Acquisition, Supply, and Development phases, it is anticipated that the total level of staffing effort for metrics collection and reporting will not exceed one person full time.

4.2 Tools for Metrics

Metrics collected, generated, and provided during the Acquisition, Supply, and Development phases will be gathered from various sources including, but not limited to, those listed below:

- ERA Action Item Database - Microsoft Access database for identification of Action Items listed by severity;

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- ERA Risk Radar - For a summary of all risks identified and tracked by Risk Exposure;
- ERA Change Request Tracking Database - Microsoft Access database for a list of change requests by number;
- ERA Peer Review Action Item Database - Microsoft Access database to be used in conjunction with the WBS to determine the number of peer reviews conducted versus those scheduled;
- ERA Deliverables Tracking Status -Microsoft Word table that tracks documentation that was submitted during the reporting period which is extracted from the WBS;
- PVCS Change History - Version control system for a complete list of Configuration Items (CIs) that have changed;
- Microsoft PowerPoint - For the latest ERA Organizational Charts;
- Microsoft Project Scheduler – For WBS, Schedule, and Earned Value Management System (EVMS);
- Microsoft Excel - For generation, storage, and reporting of metrics data including EVMS; and
- Microsoft Word - For actual generation of the Metrics Report to include presentation of the Microsoft Excel spreadsheets including description of the findings as of the end of the reporting period for each metric contained in the report.

As the volume of metrics increases, other tools may be evaluated for a match with the needs of the program.

4.3 Training

Training will be provided on the metrics collection process as specific training needs are identified. Training that will be provided, will be performed in accordance with the *ERA Training Needs Assessment (TRA)* and *PMO Training Plan (TRP)*.

5.0 Risks

According to *the IEEE Std. 1061-1998, Standard for Software Quality Metrics Methodology*, the purpose of measurement is to help management achieve project objectives, identify and track risks, satisfy constraints, and recognize problems early. A system of ERA's magnitude will not be void of risk but by utilizing the formal risk management plan and processes as detailed in the *ERA Risk Management Plan (RKM)*, involvement of program disciplines, various formal and informal reviews (e.g., Risk Review Board), and reporting methods, may help to reduce the likelihood of risks and the severity of risks when encountered.

6.0 Quality Control Measures

Updates made to the *ERA Metrics Plan (MP)* will be subject to peer review in accordance with the *ERA Peer Review Process (PRP)* document and a quality review by the QM Specialist in accordance with the *ERA Quality Management Plan (QMP)*. Anomalies detected in the quality review and peer review process of products will be fed into the appropriate ERA PMO problem tracking system. Through implementation of this process, QM will track problems until closure.

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The ERA PMO QM team will conduct process improvement reviews to review and evaluate metrics from the development effort. Findings provide information that is required to determine if processes need to be modified to prevent or reduce quality related problems. Process improvement recommendations will be an output of these reviews.

The ERA PMO QM team will also provide metric data to the ERA PD in accordance with the Metrics Analysis section of the *ERA QMP*.

The *ERA Metrics Report (MR)* will be submitted on a monthly basis and is subject to QM review in accordance with the *ERA QMP*.

7.0 Plan Maintenance

The ERA PD is responsible for this plan. As a part of process improvement (e.g., IV&V assessments, lessons learned, QM assessments), the *MP* and the overall quality management approach will continue to evolve. The plan will be updated as needed to maintain current and sufficient quality management activities. The plan will be placed under CM control following its initial approval by the ERA PMO. Updates to the *MP* will be controlled by the Configuration Control Board (CCB).

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Appendix A: ERA PMO Metrics Descriptions

Table A-1, Metric Set Definition, provides an explanation of the metric items and descriptions to enhance reader comprehension.

Item	Description
Name	Name given to the metric
Program Goals	List of program goals (measurements are goal-oriented)
Questions	Questions derived from goals that must be answered in order to determine if the goals are achieved
Impact	Indication of whether a metric can be used to alter or halt the project.
Target value	Numerical value of the metric that is to be achieved in order to meet planned objective. Include the critical value and the range of the metric.
Benefits	Provides examples of the benefits derived from using the metric.
Tools	Software or hardware tools that are used to gather and store data, compute the metric, and analyze the results.
Application	Description of how the metric is used and what its area of application is.
Data items	Input values that are necessary for computing the metric values.
Computation	Explanation of the steps involved in the metrics computation.
Interpretation	Interpretation of the results of the metrics computation.
Considerations	Provides examples of the considerations as to the appropriateness of the metric (e.g., Can data be collected for this metric? Is the metric appropriate for this application?).
Example	An example of applying the metric.
Data Source	Location of where the data is kept

Table A-1: Metric Set Definition

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Item	Description
Name	Action Item Aging
Program Goals	<ul style="list-style-type: none"> • Monitor action item closure • Monitor cost and schedule impact due to action items
Questions	<ul style="list-style-type: none"> • How many action items have been generated? • What is the status (Open/Closed) of the Action Items? • What is the impact to schedule and cost due to action item implementation?
Impact	This metric has the potential to alter the project if it is determined that the action item will cause a redesign and/or cause schedule delays.
Target Value	< 30 days old
Benefits	This metric shows the age of each open action item by severity. The data provides visibility to all open action items including those that have been outstanding for an extended period of time so that effort may be applied to ensure resolution.
Tools	MS Excel
Application	This is a program management metric used to measure product quality.
Data Items	<ul style="list-style-type: none"> • Cumulative Number of Action Items – Cumulative number of action items submitted • Cumulative Number of Action Items by Severity Level – Cumulative number of action items submitted based on Severity levels, (i.e., Critical, High, Moderate, Low) • Total Number of Open Action Items – Total number of open action items as of the end of the reporting period • Total Number of Open Action Items by Severity Level – Total number of open action items by Severity level as of the end of the reporting period. • Cumulative Number of Closed Action Items – Cumulative number of action items that were closed during the reporting period. • Cumulative Number of Closed Action Items by Severity – Cumulative number of closed action items ordered by Severity level as of the end of the reporting period. • Action Item Aging – Used to ensure all Action Items are implemented in a timely manner. It is calculated by dividing the number of open action items by the number of closed action items. • Average Time Taken to Close Action Items – Total time to implement action item divided by the total number of closed action items. • Total Time Taken to Close Action Items – Sum the number of days from the date that the action item was opened until the day the action item was closed. • Cumulative Number of Open Action Items Based on Time Interval – Number of Action Items open 0-30 days, 31 –60 days, 61 –90 days, and > 90 days • Cumulative Number of Action Items Open Per Severity and Time Interval – Number of Action Items open 0-30 days, 31–60 days, 61–90 days, and > 90 days using Critical, High, Intermediate, and Low Severity levels

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Item	Description																														
Name	Action Item Aging																														
Computation	See Data Items Section above for computations																														
Interpretation	Action items that have been open for more than 30 days need to be followed up to ensure closure. Action items of greater severity may become potential risks that can affect cost and schedule.																														
Considerations	The higher the severity the more emphasis that should be placed on bringing the action item to closure.																														
Example	<div data-bbox="500 562 1286 989" data-label="Figure"> <p>Action Items Aging Report April 2003</p> <table border="1"> <caption>Data for Action Items Aging Report</caption> <thead> <tr> <th>Days Open</th> <th>Critical</th> <th>High</th> <th>Intermediate</th> <th>Low</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>0-30</td> <td>2</td> <td>2</td> <td>4</td> <td>10</td> <td>18</td> </tr> <tr> <td>31-60</td> <td>1</td> <td>0</td> <td>3</td> <td>7</td> <td>11</td> </tr> <tr> <td>61-90</td> <td>3</td> <td>1</td> <td>1</td> <td>2</td> <td>7</td> </tr> <tr> <td>>90</td> <td>1</td> <td>1</td> <td>1</td> <td>1</td> <td>4</td> </tr> </tbody> </table> </div> <p data-bbox="748 1045 1114 1077" style="text-align: center;">Action Item Aging Example</p>	Days Open	Critical	High	Intermediate	Low	Total	0-30	2	2	4	10	18	31-60	1	0	3	7	11	61-90	3	1	1	2	7	>90	1	1	1	1	4
Days Open	Critical	High	Intermediate	Low	Total																										
0-30	2	2	4	10	18																										
31-60	1	0	3	7	11																										
61-90	3	1	1	2	7																										
>90	1	1	1	1	4																										
Data Source	Action Item Database																														

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Item	Description
Name	Change Request Inventory
Program Goals	<ul style="list-style-type: none"> • Identify trends early in their life cycle in order to reduce, eliminate, or avoid cost and schedule implications. • Identify relationships between Change Requests (CRs) and prevent perpetual CRs.
Questions	<ul style="list-style-type: none"> • What documents/software/hardware are impacted based on the required change? • What is the impact of the required change in terms of cost and schedule?
Impact	This metric can be used to alter or halt a project.
Target Value	N/A, there is no target value
Benefits	Enables the identification of trends that could have deleterious effects on cost, schedule, or performance.
Tools	MS Excel
Application	This metric lists the ERA change requests that are open as of the end of the reporting period or have been approved or disapproved during the reporting period. The data provides management with insight to the trend in new change requests and resolution as the program progresses. This is a program management metric used to measure the rate of change in order to determine potential negative trends.
Data Items	<ul style="list-style-type: none"> • Change Request – A request for modification of ERA component (i.e., document, hardware, or software) made prior to the end of the reporting period. Includes Project, Release/Version Number, Date of Request, Type of Change, Priority, Status, and Date as specified in the <i>CMP</i>. • Total Number of Change Requests Submitted – Total number of change requests that were submitted for the reporting period. • Cumulative Number of Change Requests Submitted - Cumulative number of change requests submitted up through and including the reporting period. • Total Number of Change Requests Submitted by Type of Change – Total number of change requests that were submitted for the reporting period broken down by type of change, e.g., document, hardware, software, requirements. • Cumulative Number of Change Requests Submitted by Type of Change – Cumulative number of change requests by type of change that were submitted up through and including the reporting period. • Total Number of Change Requests Approved – Total number of change requests that were approved during the reporting period. • Cumulative Number of Change Requests Approved – Cumulative number of change requests that have been approved up through and including the reporting period.

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Item	Description
Name	Change Request Inventory
	<ul style="list-style-type: none"> • Total Number of Change Requests Open – Total number of change requests that have not been approved or disapproved as of the end of the reporting period. • Total Number of Change Requests Disapproved - Total number of change requests that were disapproved during the reporting period. • Cumulative Number of Change Requests Disapproved – Cumulative number of change requests that have been disapproved up through and including the reporting period. • Total Number of Change Requests Submitted by Priority - Total number of change requests that were submitted for the reporting period broken down by priority, i.e., Critical, High, Intermediate, or Low. • Cumulative Number of Change Requests Submitted by Priority – Cumulative number of change requests by priority that were submitted up through and including the reporting period. • Total Number of Change Requests Open by Type of Change – Total number of change requests open broken down by type of change for the reporting period. • Total Number of Change Requests Open by Priority – Total number of change requests open broken down by priority for the reporting period. • Cumulative Number of Change Requests Open by Priority- Cumulative number of Change Requests open by priority up through and including the reporting period. • Cumulative Number of Change Requests Open by Type of Change - Cumulative number of Change Requests open by type of change up through and including the reporting period. • Total Number of Change Requests Disapproved by Type of Change – Total number of change requests disapproved by type of change for the reporting period. • Cumulative Number of Change Requests Disapproved by Type of Change – Cumulative number of change requests disapproved by type of change up through and including the reporting period. • Cumulative Number of Change Requests Disapproved by Priority – Cumulative number of change requests disapproved by priority up through and including the reporting period. • Total Number of Change Requests Disapproved by Priority – Total number of change requests disapproved by priority for the reporting period. • Total Number of Change Requests Approved by Type of Change – Total number of Change Requests approved broken down by type of change for the reporting period.

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Item	Description
Name	Change Request Inventory
	<ul style="list-style-type: none">• Cumulative Number of Change Requests Approved by Type of Change – Cumulative number of change requests approved broken down by type of change up through and including the reporting period.• Total Number of Change Requests Approved by Priority – Total number of Change Requests approved broken down by priority for the reporting period.• Cumulative Number of Change Requests Approved by Priority – Cumulative number of change requests approved broken priority up through and including the reporting period.
Computation	Sum of the number of change requests submitted, approved, or disapproved as of the end of the reporting period and then charted using a standard bar graph.
Interpretation	See Example
Considerations	Reinforces formal configuration control (of configuration items), i.e., no changes can be made and incorporated into the configuration baseline without approval of the Change Request.
Example	

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Item	Description																																																
Name	Change Request Inventory																																																
	<div data-bbox="646 436 1341 804" style="text-align: center;"> <table border="1" style="margin: auto;"> <caption>Change Requests Inventory Data</caption> <thead> <tr> <th>Reporting Period</th> <th>Change Requests Opened</th> <th>Change Requests Approved</th> <th>Change Requests Disapproved</th> </tr> </thead> <tbody> <tr><td>Jun-02</td><td>2</td><td>2</td><td>0</td></tr> <tr><td>Jul-02</td><td>7</td><td>7</td><td>0</td></tr> <tr><td>Aug-02</td><td>4</td><td>4</td><td>0</td></tr> <tr><td>Sep-02</td><td>3</td><td>3</td><td>0</td></tr> <tr><td>Oct-02</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>Nov-02</td><td>5</td><td>3</td><td>0</td></tr> <tr><td>Dec-02</td><td>1</td><td>3</td><td>0</td></tr> <tr><td>Jan-03</td><td>6</td><td>6</td><td>0</td></tr> <tr><td>Feb-03</td><td>2</td><td>1</td><td>0</td></tr> <tr><td>Mar-03</td><td>5</td><td>6</td><td>0</td></tr> <tr><td>Apr-03</td><td>9</td><td>9</td><td>0</td></tr> </tbody> </table> <p>Change Request Inventory Example</p> </div>	Reporting Period	Change Requests Opened	Change Requests Approved	Change Requests Disapproved	Jun-02	2	2	0	Jul-02	7	7	0	Aug-02	4	4	0	Sep-02	3	3	0	Oct-02	0	0	0	Nov-02	5	3	0	Dec-02	1	3	0	Jan-03	6	6	0	Feb-03	2	1	0	Mar-03	5	6	0	Apr-03	9	9	0
Reporting Period	Change Requests Opened	Change Requests Approved	Change Requests Disapproved																																														
Jun-02	2	2	0																																														
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Aug-02	4	4	0																																														
Sep-02	3	3	0																																														
Oct-02	0	0	0																																														
Nov-02	5	3	0																																														
Dec-02	1	3	0																																														
Jan-03	6	6	0																																														
Feb-03	2	1	0																																														
Mar-03	5	6	0																																														
Apr-03	9	9	0																																														
Data Source	Change Request Tracking Database																																																

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Item	Description
Name	Configuration Management (CM) Rate of Change
Program Goals	Monitor the number of configuration items that have been modified during the reporting period
Questions	<ul style="list-style-type: none"> • How many Configuration Items are under CM control? • How many Configuration Items have been modified?
Impact	This metric cannot be used to alter or halt a project.
Target Value	<2% as anything greater than 2% indicates that a lot of rework is occurring.
Benefits	Lends insight as to whether or not the peer review process is effective in finding discrepancies.
Tools	MS Excel or other spreadsheet package or MS Access
Application	The metric indicates how many of the Configurations Items (CIs) were modified during the reporting period.
Data Items	<ul style="list-style-type: none"> • Configuration Item - A physical or functional element controlled for the program. Includes CI Type (Document, Baseline, Hardware, or Software), CI Title, Release, Version, and Date/Time Last Modification. • Total Number of Modified CIs - A count of the CIs that were changed during the reporting period. • Total Number of CIs - The number of CIs in the CM library regardless of status as of the end of the reporting period.
Computation	$\text{CM Rate of Change} = \frac{\text{Total Number of Modified Configuration Items}}{\text{Total Number of Configuration Items}} \times 100$
Interpretation	If the rate of change is greater than 2% it can be inferred that a schedule slip may be imminent or the technical design is not sound. A rate of change greater than 2% is considered high.
Considerations	Target value could be skewed if a number of document updates have been scheduled in the same timeframe.
Example	

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Item	Description																								
Name	<p>Configuration Management (CM) Rate of Change</p> <div data-bbox="646 1012 1360 1396" data-label="Figure"> <table border="1"> <caption>CM Rate of Change Data</caption> <thead> <tr> <th>Reporting Period</th> <th>CM Percentage Rate of Change</th> </tr> </thead> <tbody> <tr><td>Jun-02</td><td>12.90</td></tr> <tr><td>Jul-02</td><td>8.57</td></tr> <tr><td>Aug-02</td><td>26.09</td></tr> <tr><td>Sep-02</td><td>2.33</td></tr> <tr><td>Oct-02</td><td>1.12</td></tr> <tr><td>Nov-02</td><td>1.11</td></tr> <tr><td>Dec-02</td><td>0.52</td></tr> <tr><td>Jan-03</td><td>0.00</td></tr> <tr><td>Feb-03</td><td>1.01</td></tr> <tr><td>Mar-03</td><td>0.50</td></tr> <tr><td>Apr-03</td><td>2.30</td></tr> </tbody> </table> </div> <p>CM Rate of Change Example</p>	Reporting Period	CM Percentage Rate of Change	Jun-02	12.90	Jul-02	8.57	Aug-02	26.09	Sep-02	2.33	Oct-02	1.12	Nov-02	1.11	Dec-02	0.52	Jan-03	0.00	Feb-03	1.01	Mar-03	0.50	Apr-03	2.30
Reporting Period	CM Percentage Rate of Change																								
Jun-02	12.90																								
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Nov-02	1.11																								
Dec-02	0.52																								
Jan-03	0.00																								
Feb-03	1.01																								
Mar-03	0.50																								
Apr-03	2.30																								
Data Source	PVCS																								

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Item	Description
Name	Cumulative Monthly Actual Cost
Program Goals	<ul style="list-style-type: none"> • Track the allocated budget for the reporting period • Track the cost outlays for the reporting period • Track the number of obligations for the reporting period • Track resource costs such as labor rates and labor hours
Questions	<ul style="list-style-type: none"> • What is the total budget allocation for the reporting period? • What are the total cost outlays for the reporting period? • What are the total obligations for the reporting period? • What are the total labor costs for the reporting period?
Impact	This metric can be used to alter or halt a project if it is determined that there are substantial cost overruns.
Target Value	±5% over/under budgeted costs
Benefits	Shows immediately if there is a cost overrun
Tools	MS Excel or other spreadsheet package
Application	This a program management application used to monitor/track financial performance (cost). The data is broken down by task and compared to the original budget estimate. Support activities, such as Configuration Management, are included. The metric assists in the identification of expenditure problems.
Data Items	<ul style="list-style-type: none"> • Work Performed - Completion, including required approval, of an ERA work product (i.e., document, software, hardware). • Original Budget Estimate - The budget allocated to perform work on the program in the contract proposal. • Outlays - Total expenditures incurred to perform the work through the end of the reporting period. • Obligations - Total monies obligated for the reporting period
Computation	Sum totals for reporting month and then display using bar graph.
Interpretation	<ul style="list-style-type: none"> • If total budgeted costs are being exceeded by >5% it can be inferred that a schedule slip due to excessive rework or poor planning/estimating may be imminent. • If total budgeted costs are <5% it may be an indication that tasks are not completed and/or it could indicate that a wrong labor mix is being utilized.
Considerations	Can be used to calculate resource costs such as labor costs x labor hours

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Item	Description																																
Name	Cumulative Monthly Actual Cost																																
Example	<div data-bbox="548 789 1357 1199" style="text-align: center;"> <table border="1" style="margin: 10px auto;"> <caption>Cumulative Monthly Actual Cost Fiscal Year 2003</caption> <thead> <tr> <th>Reporting Period</th> <th>FY03 Budget (US Dollars)</th> <th>FY03 Obligations (US Dollars)</th> <th>FY03 Outlays (US Dollars)</th> </tr> </thead> <tbody> <tr> <td>Oct</td> <td>~\$1,800,000</td> <td>~\$400,000</td> <td>~\$700,000</td> </tr> <tr> <td>Nov</td> <td>~\$1,800,000</td> <td>~\$100,000</td> <td>~\$1,400,000</td> </tr> <tr> <td>Dec</td> <td>~\$1,800,000</td> <td>~\$100,000</td> <td>~\$700,000</td> </tr> <tr> <td>Jan</td> <td>~\$1,800,000</td> <td>~\$2,900,000</td> <td>~\$900,000</td> </tr> <tr> <td>Feb</td> <td>~\$1,800,000</td> <td>~\$100,000</td> <td>~\$500,000</td> </tr> <tr> <td>Mar</td> <td>~\$1,300,000</td> <td>~\$100,000</td> <td>~\$1,500,000</td> </tr> <tr> <td>Apr</td> <td>~\$1,300,000</td> <td>~\$100,000</td> <td>~\$1,300,000</td> </tr> </tbody> </table> </div> <p data-bbox="737 1241 1195 1272" style="text-align: center;">Cumulative Monthly Cost Example</p>	Reporting Period	FY03 Budget (US Dollars)	FY03 Obligations (US Dollars)	FY03 Outlays (US Dollars)	Oct	~\$1,800,000	~\$400,000	~\$700,000	Nov	~\$1,800,000	~\$100,000	~\$1,400,000	Dec	~\$1,800,000	~\$100,000	~\$700,000	Jan	~\$1,800,000	~\$2,900,000	~\$900,000	Feb	~\$1,800,000	~\$100,000	~\$500,000	Mar	~\$1,300,000	~\$100,000	~\$1,500,000	Apr	~\$1,300,000	~\$100,000	~\$1,300,000
Reporting Period	FY03 Budget (US Dollars)	FY03 Obligations (US Dollars)	FY03 Outlays (US Dollars)																														
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Jan	~\$1,800,000	~\$2,900,000	~\$900,000																														
Feb	~\$1,800,000	~\$100,000	~\$500,000																														
Mar	~\$1,300,000	~\$100,000	~\$1,500,000																														
Apr	~\$1,300,000	~\$100,000	~\$1,300,000																														
Data Source	Monthly Activity Report based upon ERA Weekly Activity Report data input to CostPoint.																																

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Item	Description
Name	Earned Value Management System
Program Goals	<ul style="list-style-type: none"> • Monitor performance, cost, and schedule using a timeline • Monitor the schedule and completion of work products relative to their scheduled and actual completion times • Ensure the project has sufficient resources • Determine how much of the planned work has been done • Forecast the final spending and completion date • Provide an early warning when the project starts to go off-track • Discover which areas/tasks are causing the problems, and where anomalies are occurring • Demonstrate and keep the project/development under control • Track total number of hours per task (cumulative), both budgeted and actual during the reporting period • Track total number of hours spent to complete a task
Questions	<ul style="list-style-type: none"> • How is the project performing with respect to cost? • How is the project performing with respect to schedule? • Is the work force sufficient to complete the work and how well are they performing? • What are the staffing levels: Actual, Planned, Variance? • Is the correct labor mix being utilized? • Is project performance increasing? • How much work/how many tasks has/have been completed as compared to the plan? • Will the project complete on time? • Is scheduled work being completed on time? • Is scheduled work being completed within cost parameters? • Is the total number of hours (actual) spent working on a task more than the budgeted amount? • Is a pattern emerging where it is taking longer than planned to complete particular tasks? • Is the overrun of hours required to complete a task in a particular component area? • Was the prepared budget inadequate for the amount of work to be performed? • Is the component area more technically challenging than originally anticipated?
Impact	<p>These metrics can be used to monitor progress, provide early warnings of problems, trends, enable process improvement, and enable decision making whether to continue work on the project.</p>

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Item	Description
Name	Earned Value Management System
Target Value	<ul style="list-style-type: none"> • Using EVMS, no credit is given unless milestones/tasks are one hundred percent complete. • Cost Performance Index (CPI) <1.00 indicates potential productivity problem. • Level Of Effort (LOE) > 100% of planned effort required to complete activity - If the cumulative actual labor hours exceed cumulative budgeted hours to complete a task(s), this could be indicative of poor estimation and planning, leading to overruns and shortening of the test cycle to get back on schedule. • This could also indicate wrong level of labor mix.
Benefits	<ul style="list-style-type: none"> • CPI shows how efficiently the team has turned costs into progress to date. • CPI represents how much work was performed for each dollar spent. • Schedule Performance Index (SPI) establishes the performance baseline against which the program can compare actual performance data. SPI is a schedule variance parameter. • Reviewing for potential threats • Timeliness of accurate (realtime) data providing ample time to act
Tools	<ul style="list-style-type: none"> • MS Excel • MS Project.
Application	<ul style="list-style-type: none"> • This is a program management metric used to monitor cost, performance, and schedule. • The SPI compares performance to the schedule. The indices of CPI and SPI are the standard cost and schedule performance measures for both government and industry. The CPI shows how efficiently the team has turned costs into progress to date CPI represents how much work was performed for each dollar spent. • The primary report used for analysis of performance in an EVMS system is the cost/schedule status report and it includes PV, AC, EV, and EAC in addition to calculated cost and schedule variance for each WBS element from the cost account level up to the project level. • VARs provide current period, cumulative, and at-completion data. VAR contains a description of the cause of the variance, its impact on the project including other elements of the project, corrective action to be taken, and follow-up on previous action taken. Variance thresholds may be reported as a percentage, dollar amount, or a combination of the two.
Data Items	<ul style="list-style-type: none"> • Budget At Completion (BAC) - The total value assigned to the program and, if all goes as planned, the total cost. The planned value accounts for all direct and indirect labor (expressed in dollars) that the work is expected to cost. • Planned Value (PV) – The sum of budgets allocated to time-phased

FINAL

Item	Description
Name	Earned Value Management System
	<p>elements of work (Work Packages (WP)) on the program; the planned value.</p> <ul style="list-style-type: none"> • Earned Value (EV) – The budgeted cost of work recorded when the work is actually completed; earned value. • Actual Cost (AC) – The actual, not the estimated, cost of the work performed to-date. • Task - The lowest level of effort in the ERA program schedule. • Cumulative Budgeted Labor Hours - Total number of hours to be worked on a task through the end of the reporting period as defined in the contract. Includes Task Name and Task Cumulative Estimated Labor Hours. • Total Budgeted Labor Hours - Total number of hours to be expended to complete a task as defined in the contract. Includes Task Name and Task Total Estimated Labor Hours. • Cumulative Actual Labor Hours - Total number of hours spent working on a task through the end of the reporting period. Includes Task Name, Task Cumulative Estimated Labor Hours, Task Actual Labor Hours, and Task Cumulative Actual Labor Hours.
Computations	<ul style="list-style-type: none"> • Estimate at Completion (EAC) = This formula determines the unfinished or unearned work given by the formula. $\text{Estimate at Completion (EAC)} = \frac{\text{BAC}}{\text{CPI}}$ <p>A poor performance, or CPI less than 1, results in an EAC that is greater than the BAC</p> • Variance at Completion (VAC) = The difference between the EAC and the BAC given by the following formula: $\text{Variance at Completion (VAC)} = \text{EAC} - \text{BAC}$ <p>When the projected final cost exceeds the budget, the Development Contractor is effectively predicting an overrun, termed an Adverse Variance at Completion.</p> • Cost Variance (CV) = The difference between EV and AC given by the formula:

FINAL

Item	Description
Name	<p>Earned Value Management System</p> <p>Cost Variance = EV - AC</p> <p>OR</p> <p>Cost Variance Percentage = $\frac{CV}{EV} \times 100$</p> <ul style="list-style-type: none"> • Schedule Variance (SV) = The difference between EV and PV given by the formula: <p>Schedule Variance = EV - PV</p> <p>Or</p> <p>Schedule Variance Percentage = $\frac{SV}{PV} \times 100$</p> <ul style="list-style-type: none"> • Schedule Performance Index (SPI) = EV divided by PV as given by the formula: <p>Schedule Performance Index = $\frac{EV}{PV}$</p> <ul style="list-style-type: none"> • Cost Performance Index (CPI) = EV divided by the AC given by the formula: <p>Cost Performance Index = $\frac{EV}{AC}$</p> <p>A CPI of less than a 1.0 indicates potential productivity problem</p>

FINAL

Item	Description
Name	Earned Value Management System
	<ul style="list-style-type: none"> • Variance At Completion (VAC) = Variance at Completion (VAC) = BAC – EAC • To Complete Performance Index (TCPI) shows the future projection of the average productivity needed to complete the program within an estimated budget. It is calculated by the following formula: $\text{To Complete Performance Index (BAC)} = \frac{\text{Work Remaining}}{\text{Money Remaining}} = \frac{\text{BAC} - \text{EV}}{\text{BAC} - \text{AC}}$ $\text{To Complete Performance Index (EAC)} = \frac{\text{Work Remaining}}{\text{Money Remaining}} = \frac{\text{BAC} - \text{EV}}{\text{EAC} - \text{AC}}$ • Estimate at Completion (EAC) = The difference between the Estimate at Completion and Actual Cost given by the formula: $\text{Estimate at Completion (EAC)} = \frac{\text{BAC}}{\text{CPI}}$
Interpretation	<ul style="list-style-type: none"> • The closer the CPI and SPI are to a value of 1.00, the more successful the program can be considered, at least in terms of cost and schedule. • >5% LOE may present problems when trying to measure project performance • TCPI is compared with CPI to determine how realistic the most recent EAC is for the program. If TCPI is greater than CPI ($CPI/TCPI < 1$), the team is anticipating an efficiency improvement. The estimated total cost of the program (EAC) can therefore be calibrated by comparing TCPI with CPI. If TCPI is 20 percent above the current value of the CPI, both indices require closer examination.
Considerations	In order to use the metrics the program/project must: <ul style="list-style-type: none"> • Have produced a Work Breakdown Structure (WBS):

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Item	Description
Name	Earned Value Management System
	<ul style="list-style-type: none"> - Have produced a logical and resourced Baseline Plan - Have separated the total budget into effort (labor-hours) and material costs - Have allocated the effort element amongst all of the tasks using best estimating techniques - Record the effort spent on each task (planned versus actual) - Re-forecast the effort required to complete each task every month (need input each month) - Decide how to divide up the work for Metrics Reporting • Effort requires due diligence to make EVMS reporting worthwhile and data needs to be timely and current • Quantify LOE in order to establish a viable baseline, i.e., the Project Manager must know how much LOE is in the baseline • Keep all LOE in a single bucket never co-mingling it with discrete work • If LOE is skewed to the left, toward the front-end of the baseline, then it may distort performance • LOE has been criticized because it does not measure performance but rather measures the passage of time, i.e., with LOE, work does not have to be performed. The Planned Value merely must have a value, and Earned Value performance will equate to the plan. LOE may mask serious problems in project performance because positive LOE performance will offset negative discrete results. To avoid this, the amount of LOE work must be quantified; LOE should always be kept in “one bucket” and not co-mingle with discretely measured work in order to allow for the accurate measurement of performance to the project baseline • To prepare ETC, the following items should be considered: <ul style="list-style-type: none"> - Cumulative AC divided by ordered commitments, - Schedule status, - EV to-date, - Remaining scope of work, - Previous ETC, - Historical data, - Required resources by type, - Projected cost and schedule efficiency improvement, - Future actions, and - Approved contract changes.

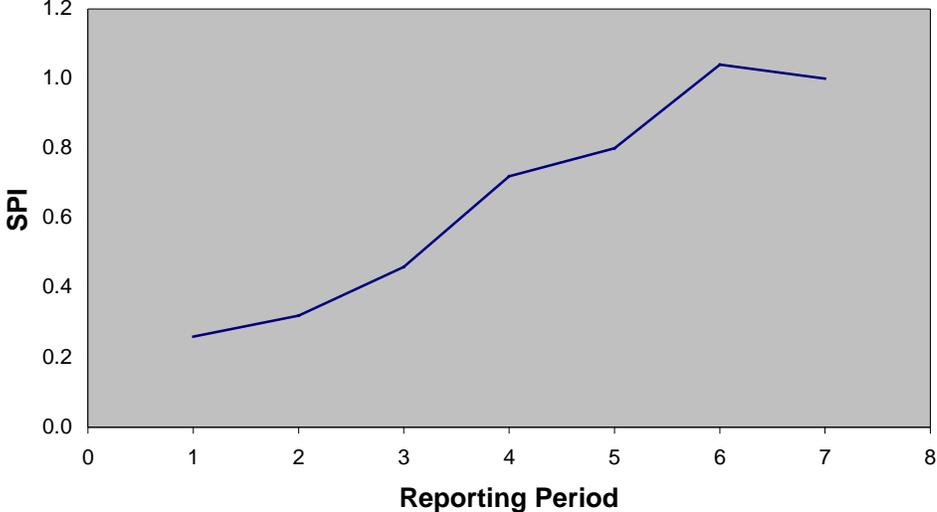
FINAL

Item	Description
Name	Earned Value Management System
Example	<p style="text-align: center;">EVMS Example</p>

FINAL

Item	Description
Name	Earned Value Management System
	<p data-bbox="747 934 1185 966">Cost Performance Index Example</p>

FINAL

Item	Description
Name	Earned Value Management System
	 <p data-bbox="721 961 1211 993">Schedule Performance Index Example</p>

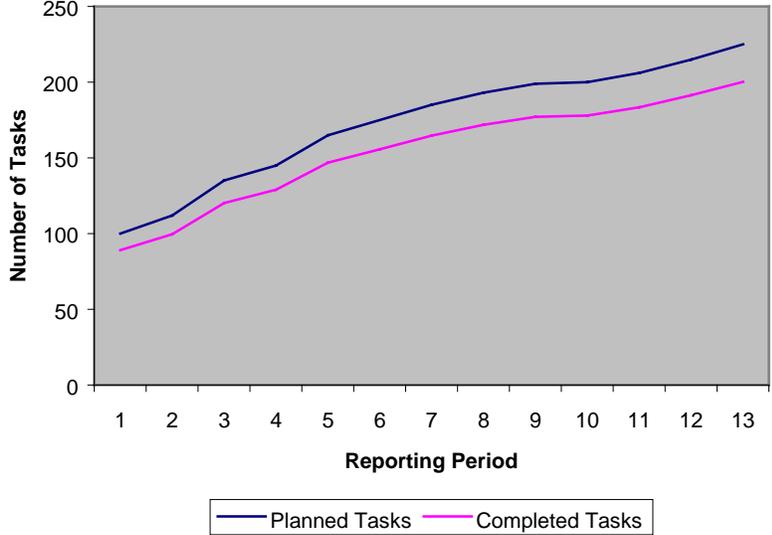
FINAL

Item	Description																
Name	Earned Value Management System																
	<p style="text-align: center;">To Complete Performance Index Example</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <caption>TCPI Data Points</caption> <thead> <tr> <th>Reporting Period</th> <th>TCPI</th> </tr> </thead> <tbody> <tr><td>1</td><td>0.50</td></tr> <tr><td>2</td><td>0.55</td></tr> <tr><td>3</td><td>0.95</td></tr> <tr><td>4</td><td>1.00</td></tr> <tr><td>5</td><td>0.60</td></tr> <tr><td>6</td><td>0.80</td></tr> <tr><td>7</td><td>1.00</td></tr> </tbody> </table>	Reporting Period	TCPI	1	0.50	2	0.55	3	0.95	4	1.00	5	0.60	6	0.80	7	1.00
Reporting Period	TCPI																
1	0.50																
2	0.55																
3	0.95																
4	1.00																
5	0.60																
6	0.80																
7	1.00																
Data Source	Monthly Activity Reports based on input to CostPoint																

FINAL

Item	Description
Name	Milestone Completion Summary
Program Goals	Track scheduled milestones to see if they have been met
Questions	<ul style="list-style-type: none"> • What is the total number of milestones scheduled for the reporting period? • What is the total number of milestones that were met completely (i.e., one hundred percent) for the reporting period?
Impact	<ul style="list-style-type: none"> • When the Number of Milestones Completed is less than the number planned by a significant amount, it can be inferred that a schedule slip is imminent. • Not meeting the scheduled milestones can have an impact on Earned Value.
Target Value	< 95% actual completion of planned tasks since strategic goal is <10% schedule slippage.
Benefits	The metric provides insight to concurrent scheduling and the projected program completion date and supports performance monitoring.
Tools	<ul style="list-style-type: none"> • MS Excel • MS Project Scheduler
Application	This is a program management metric used to show completion status of milestones at the end of the reporting period.
Data Items	<ul style="list-style-type: none"> • Milestone - A significant task in the ERA program as designated in the program schedule and used in Earned Value planning with zero duration. • Cumulative Number of Planned Milestone(s) - Cumulative number of planned/scheduled milestones as indicated in the program schedule. Includes Milestone Name and Milestone Scheduled Finish Date. • Cumulative Number of Completed Milestone(s) - Cumulative number of completed milestones. Includes Milestone Name, and Milestone Scheduled Finish Date, and Milestone Actual Finish Date.
Computation	$\text{Milestone Completion Rate} = \frac{\text{Cumulative Number of Completed Milestones}}{\text{Cumulative Number of Scheduled Milestones}} \times 100$
Interpretation	A schedule slip can occur if the rate of completion for planned tasks falls below 95%.
Considerations	None

FINAL

Item	Description																																										
Name	Milestone Completion Summary																																										
Example	 <p style="text-align: center;">Milestone Completion Summary</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <caption>Estimated Data for Milestone Completion Summary</caption> <thead> <tr> <th>Reporting Period</th> <th>Planned Tasks</th> <th>Completed Tasks</th> </tr> </thead> <tbody> <tr><td>1</td><td>100</td><td>90</td></tr> <tr><td>2</td><td>115</td><td>100</td></tr> <tr><td>3</td><td>140</td><td>125</td></tr> <tr><td>4</td><td>150</td><td>135</td></tr> <tr><td>5</td><td>170</td><td>150</td></tr> <tr><td>6</td><td>185</td><td>160</td></tr> <tr><td>7</td><td>195</td><td>170</td></tr> <tr><td>8</td><td>200</td><td>175</td></tr> <tr><td>9</td><td>205</td><td>180</td></tr> <tr><td>10</td><td>205</td><td>180</td></tr> <tr><td>11</td><td>210</td><td>185</td></tr> <tr><td>12</td><td>220</td><td>190</td></tr> <tr><td>13</td><td>230</td><td>200</td></tr> </tbody> </table>	Reporting Period	Planned Tasks	Completed Tasks	1	100	90	2	115	100	3	140	125	4	150	135	5	170	150	6	185	160	7	195	170	8	200	175	9	205	180	10	205	180	11	210	185	12	220	190	13	230	200
Reporting Period	Planned Tasks	Completed Tasks																																									
1	100	90																																									
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8	200	175																																									
9	205	180																																									
10	205	180																																									
11	210	185																																									
12	220	190																																									
13	230	200																																									
Data Source	MS Project Scheduler																																										

FINAL

Item	Description
Name	Program Staffing Profile
Program Goals	Monitor the staffing levels required to perform program tasks against projected staffing levels
Questions	<ul style="list-style-type: none"> • What is the projected number of ERA PMO Government Staff required to perform designated tasks? • What is the actual number of ERA PMO Government Staff required to perform designated tasks? • What is the projected number of ERA PMO POST Staff required to perform designated tasks? • What is the actual number of ERA PMO POST Staff required to perform designated tasks?
Impact	Lack of resources could result in schedule slippage due to work overload.
Target Value	< 90% projected staffing level could impact tasks being completed on time which translates into a potential schedule slip.
Benefits	When staffing levels are above the threshold it means that sufficient resources are available to perform required tasks.
Tools	MS Excel
Application	This is a program management metric used to monitor resources and cost
Data Items	<ul style="list-style-type: none"> • Projected Staffing Level - Identification of ERA staffing required to complete program activities by reporting period. Includes Staffing Category and for each Staffing Category, the Number of Staff Members, and Staffing Scheduled Finish Date. • Program Staffing Level - Actual ERA staffing by Staffing Category as of the end of the reporting period. Includes Staffing Category and for each Staffing Category, the Number of Staff Members, Staff Member Names, and Reporting Period. • Number of Projected ERA Staff – Total number of staff for the ERA project, includes both Government and POST staff combined cumulative up to and including the reporting period. • Actual Number of ERA Staff – Actual number of staff for the ERA project, includes both Government and POST staff combined cumulative up to and including the reporting period. • Number of Projected Government Staff – Total number of projected Government staff required to complete program activities up to and including the reporting period. • Actual Number of Government Staff – Actual number of Government staff to-date. • Number of Projected POST Staff – Total number of projected POST staff required to complete program activities up to and including the reporting period.

FINAL

	<ul style="list-style-type: none"> • Actual Number of POST Staff – Actual number of POST staff to-date • Number of Projected Government Staff by Division (i.e., PMO Total, PMO PO, PMO PMD, PMO SED) – Total number of Government projected Government staff by division required to complete program activities up to and including the reporting period. • Actual Number of Projected Government Staff by Division – Actual number of Government staff to-date by division. • Number of Projected POST Staff by Division (i.e., POST Total, POST PO, POST PMD, POST SED) – Total number of projected POST staff by division required to complete program activities up to and including the reporting period. • Actual Number of POST Staff by Division – Actual number of POST staff to-date by division. 																																								
Computation	$\text{Staffing Profile \% Rate} = \frac{\text{Total Number of Actual Staff}}{\text{Total Number of Projected Staff}} \times 100$																																								
Interpretation	If staffing is too low, then there is the potential for schedule slippage as tasks may not be completed as scheduled.																																								
Considerations	Can be used in conjunction with or to help support level of effort																																								
Example	<table border="1"> <caption>Program Staffing Level Example Data</caption> <thead> <tr> <th>Reporting Period</th> <th>Projected Staffing Levels</th> <th>Total Technical Staff</th> <th>Total Other Staff</th> </tr> </thead> <tbody> <tr><td>1</td><td>20</td><td>5</td><td>5</td></tr> <tr><td>2</td><td>32</td><td>12</td><td>10</td></tr> <tr><td>3</td><td>45</td><td>18</td><td>12</td></tr> <tr><td>4</td><td>60</td><td>20</td><td>15</td></tr> <tr><td>5</td><td>72</td><td>35</td><td>15</td></tr> <tr><td>6</td><td>75</td><td>42</td><td>18</td></tr> <tr><td>7</td><td>78</td><td>45</td><td>20</td></tr> <tr><td>8</td><td>78</td><td>48</td><td>22</td></tr> <tr><td>9</td><td>80</td><td>50</td><td>28</td></tr> </tbody> </table> <p style="text-align: center;">Program Staffing Level Example</p>	Reporting Period	Projected Staffing Levels	Total Technical Staff	Total Other Staff	1	20	5	5	2	32	12	10	3	45	18	12	4	60	20	15	5	72	35	15	6	75	42	18	7	78	45	20	8	78	48	22	9	80	50	28
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FINAL

	<div data-bbox="630 226 1323 640" style="text-align: center;"> <p>Program Staffing Profile Breakdown April 2003</p> <table border="1"> <caption>Data for Program Staffing Profile Breakdown (April 2003)</caption> <thead> <tr> <th>Organization</th> <th>Total Projected Staff</th> <th>Total Actual Staff to Date</th> </tr> </thead> <tbody> <tr> <td>PMO Total</td> <td>25</td> <td>15</td> </tr> <tr> <td>PMO Program Office</td> <td>7</td> <td>5</td> </tr> <tr> <td>PMO PMD</td> <td>8</td> <td>3</td> </tr> <tr> <td>PMO SED</td> <td>10</td> <td>7</td> </tr> <tr> <td>POST Total</td> <td>25</td> <td>24</td> </tr> <tr> <td>POST Program Office</td> <td>7</td> <td>7</td> </tr> <tr> <td>POST PMD</td> <td>8</td> <td>7</td> </tr> <tr> <td>POST SED</td> <td>10</td> <td>10</td> </tr> </tbody> </table> </div> <p style="text-align: center;">Program Staffing Profile Example</p>	Organization	Total Projected Staff	Total Actual Staff to Date	PMO Total	25	15	PMO Program Office	7	5	PMO PMD	8	3	PMO SED	10	7	POST Total	25	24	POST Program Office	7	7	POST PMD	8	7	POST SED	10	10
Organization	Total Projected Staff	Total Actual Staff to Date																										
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POST Total	25	24																										
POST Program Office	7	7																										
POST PMD	8	7																										
POST SED	10	10																										
Data Source	MS Excel Spreadsheet																											

FINAL

Item	Description
Name	Risk Containment Summary
Program Goals	<ul style="list-style-type: none"> • Track risks by risk exposure • Identify trends • Develop risk strategies to mitigate, reduce, or eliminate potential risks
Questions	<ul style="list-style-type: none"> • What is the total number of risks that have been identified? • What is the total number of high exposure risks? • What is the total number of moderate exposure risks? • What is the total number of low exposure risks?
Impact	Can be used to halt or alter the project depending on the severity of the risk.
Target Value	N/A, there is no threshold
Benefits	This measure provides a useful summary for management to identify trends in risk identification in order to be able to monitor them and to also develop strategies to mitigate, reduce, or eliminate them.
Tools	Risk Radar
Application	The metric is a program management metric used to monitor all risk items.
Data Items	<ul style="list-style-type: none"> • Cumulative Number of Open Risk Items – Cumulative number of open risk items up to and including the reporting period. • Cumulative Number of Open Risk Items by Risk Exposure (i.e., High, Moderate, Low) – Total number of open risk items by risk exposure level that are open as of the end of the reporting period. <ul style="list-style-type: none"> – High Exposure: Risks that have a significant impact on cost, schedule, or performance. Significant action required. – Moderate Exposure: Risks that have some impact. Special action may be required. Additional management attention may be required. – Low Exposure: Risks that have minimum impact. Normal oversight needed to ensure risk remains low. • Cumulative Number of Closed Risk Items – Total number of closed risk items by risk exposure level that have been closed for the reporting period. • Cumulative Number of Closed Risk Items by Exposure Level – Total number of closed risk items by risk exposure level that have been closed as of the end of the reporting period.

FINAL

Item	Description
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Name

Risk Containment Summary

Computation

Risk Exposure is determined using: Impact multiplied by Likelihood/Probability.

Risk Impact Level and Likelihood/Probability are determined using the following:

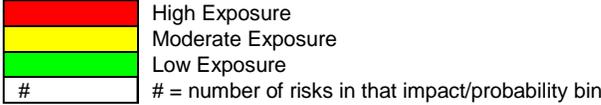
<i>Level</i>	<i>Technical Performance</i>	<i>Schedule</i>	<i>Cost</i>	<i>Impact on Other Teams</i>
1	Minimal or no Impact	Minimal or No Impact.	Minimal or no Impact	None
2	Acceptable with some reduction in margin	Additional resources required. Able to meet need dates.	<5%	Some impact
3	Acceptable with significant reduction in margin	Minor slip in key milestone. Not able to meet need dates.	5 – 7%	Moderate impact
4	Acceptable – no remaining margin	Major slip in key milestone or critical path impacted.	>7<10%	Major impact
5	Unacceptable	Can't achieve key team or major program milestone.	>10%	Unacceptable

Risk Impact Chart Example

FINAL

Item	Description																																						
Name	Risk Containment Summary																																						
Interpretation	Less than a 95% completion rate could infer a schedule slip is imminent.																																						
Considerations	Additional risk management data including strategies can be found in the <i>ERA Risk Management Plan (RKM)</i> . The metric data presented here is a subset of that data. Lastly, risk management reports containing additional metric data is reported on at various times providing more detail than what is being reported here.																																						
Example	<div style="text-align: center;"> <table border="1" data-bbox="657 1213 1446 1640"> <tr> <td></td> <td style="background-color: cyan;">5</td> <td style="background-color: yellow;"></td> <td style="background-color: yellow;"></td> <td style="background-color: red;"></td> <td style="background-color: red;"></td> <td style="background-color: red;">1</td> </tr> <tr> <td rowspan="5" style="vertical-align: middle;">Impact</td> <td style="background-color: cyan;">4</td> <td style="background-color: green;"></td> <td style="background-color: yellow;"></td> <td style="background-color: yellow;"></td> <td style="background-color: red;">3</td> <td style="background-color: red;"></td> </tr> <tr> <td style="background-color: cyan;">3</td> <td style="background-color: green;"></td> <td style="background-color: yellow;">2</td> <td style="background-color: yellow;">4</td> <td style="background-color: red;"></td> <td style="background-color: red;"></td> </tr> <tr> <td style="background-color: cyan;">2</td> <td style="background-color: green;">3</td> <td style="background-color: green;">1</td> <td style="background-color: yellow;"></td> <td style="background-color: yellow;"></td> <td style="background-color: yellow;"></td> </tr> <tr> <td style="background-color: cyan;">1</td> <td style="background-color: green;">2</td> <td style="background-color: green;">4</td> <td style="background-color: green;"></td> <td style="background-color: green;"></td> <td style="background-color: green;"></td> </tr> <tr> <td></td> <td style="background-color: cyan;">1 - 20</td> <td style="background-color: cyan;">21 - 40</td> <td style="background-color: cyan;">41 - 60</td> <td style="background-color: cyan;">61 - 80</td> <td style="background-color: cyan;">81 - 99</td> </tr> </table> <p data-bbox="917 1654 1187 1682">Likelihood /Probability (%)</p> <p data-bbox="467 1808 574 1843">Legend:</p> </div>		5					1	Impact	4				3		3		2	4			2	3	1				1	2	4					1 - 20	21 - 40	41 - 60	61 - 80	81 - 99
	5					1																																	
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FINAL

Item	Description
Name	Risk Containment Summary
	 <p data-bbox="727 657 1214 693">Risk Containment Summary Example</p>
Data Source	Risk Radar

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Item	Description
Name	Work Product Completion Summary
Program Goals	Track the number of work products that are scheduled for delivery and those that are actually delivered on a cumulative basis.
Questions	<ul style="list-style-type: none"> • What is the number of work products, e.g., documents, scheduled for submission during the reporting period? • What is the number of actual work products submitted during the reporting period?
Impact	<ul style="list-style-type: none"> • Can be used to alter or halt a project if it is determined that the schedule is not being met. • Can be used to alter or halt a project if the deliverable work product(s) is of significance and tied to completion of a program milestone.
Target Value	< 95% completed on time since strategic goal is < 10% schedule slippage
Benefits	Can determine if a program is on schedule or if milestones tied to the deliverable are going to be met.
Tools	<ul style="list-style-type: none"> • MS Word table for deliverables list for the reporting period to be used in conjunction with the ERA WBS and Schedule (MS Project Scheduler) • MS Excel to chart metric data
Application	The metric presents the Cumulative Number of Work Products Completed and the Cumulative Number of Work Products Scheduled for completion.
Data Items	<ul style="list-style-type: none"> • Cumulative Number of Work Products Scheduled - Cumulative number of ERA deliverables that are scheduled for completion by the end of the reporting period in the program schedule. Includes Work Product Name, Work Product Type, Work Product Scheduled Finish Date, and Actual # of deliverables submitted. • Cumulative Number Work Products Completed - Cumulative number of ERA deliverables that were completed as of the end of the reporting period. Includes Work Product Name, Work Product Type, Work Product Scheduled Finish Date, and Work Product Actual Finish Date.
Computation	$\text{Work Product Completion Rate} = \frac{\text{Cumulative Number of Work Products Completed}}{\text{Cumulative Number of Work Products Scheduled}} \times 100$
Interpretation	Less than a 95% completion rate could infer a schedule slip is imminent
Considerations	None

FINAL

Item	Description																																				
Name	Work Product Completion Summary																																				
Example	<div data-bbox="586 945 1341 1350" style="text-align: center;"> <table border="1" style="margin: 10px auto;"> <caption>Work Product Completion Summary Example</caption> <thead> <tr> <th>Reporting Period</th> <th>Cumulative Scheduled</th> <th>Cumulative Completed</th> </tr> </thead> <tbody> <tr><td>Jun-02</td><td>4</td><td>4</td></tr> <tr><td>Jul-02</td><td>12</td><td>11</td></tr> <tr><td>Aug-02</td><td>17</td><td>18</td></tr> <tr><td>Sep-02</td><td>27</td><td>27</td></tr> <tr><td>Oct-02</td><td>33</td><td>33</td></tr> <tr><td>Nov-02</td><td>35</td><td>34</td></tr> <tr><td>Dec-02</td><td>42</td><td>39</td></tr> <tr><td>Jan-03</td><td>47</td><td>43</td></tr> <tr><td>Feb-03</td><td>51</td><td>46</td></tr> <tr><td>Mar-03</td><td>57</td><td>50</td></tr> <tr><td>Apr-03</td><td>67</td><td>56</td></tr> </tbody> </table> </div>	Reporting Period	Cumulative Scheduled	Cumulative Completed	Jun-02	4	4	Jul-02	12	11	Aug-02	17	18	Sep-02	27	27	Oct-02	33	33	Nov-02	35	34	Dec-02	42	39	Jan-03	47	43	Feb-03	51	46	Mar-03	57	50	Apr-03	67	56
Reporting Period	Cumulative Scheduled	Cumulative Completed																																			
Jun-02	4	4																																			
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Jan-03	47	43																																			
Feb-03	51	46																																			
Mar-03	57	50																																			
Apr-03	67	56																																			
Data Source	MS Project Scheduler																																				

FINAL

Appendix B: ERA Development Contractor Metrics Descriptions

Table B-1, Metric Set Definition, provides an explanation of the metric items and descriptions to enhance reader comprehension.

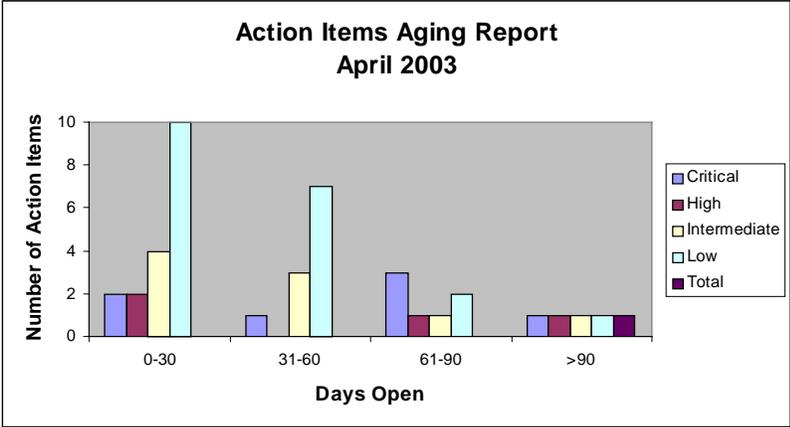
Item	Description
Name	Name given to the metric
Program Goals	List of program goals (measurements are goal-oriented)
Questions	Questions derived from goals that must be answered in order to determine if the goals are achieved
Impact	Indication of whether a metric can be used to alter or halt the project.
Target value	Numerical value of the metric that is to be achieved in order to meet planned objective. Include the critical value and the range of the metric.
Benefits	Provides examples of the benefits derived from using the metric.
Tools	Provides examples of software or hardware tools that are used to gather and store data, compute the metric, and analyze the results.
Application	Description of how the metric is used and what its area of application is.
Data items	Input values that are necessary for computing the metric values.
Computation	Explanation of the steps involved in the metrics computation.
Interpretation	Interpretation of the results of the metrics computation.
Considerations	Provides examples of considerations of the appropriateness of the metric (e.g., Can data be collected for this metric? Is the metric appropriate for this application?).
Example	An example of applying the metric.
Data Source	Provides examples of locations where the data is kept

Table B-1: Metric Set Definition

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Item	Description
Name	Action Item Aging
Program Goals	<ul style="list-style-type: none"> • Monitor action item closure • Monitor cost and schedule impact due to action items
Questions	<ul style="list-style-type: none"> • How many action items have been generated? • What is the status (Open/Closed) of the Action Items? • What is the impact to schedule and cost due to action item implementation?
Impact	This metric has the potential to alter the project if it is determined that the action item will cause a redesign and/or cause schedule delays.
Target Value	< 30 days old
Benefits	This metric shows the age of each open action item by severity. The data provides visibility to action items that have been outstanding for an extended period of time so that effort may be applied to ensure resolution.
Tools	Development Contractor Defined
Application	This is a program management metric used to measure product quality and contractor performance.
Data Items	<ul style="list-style-type: none"> • Cumulative Number of Action Items – Cumulative number of action items submitted • Cumulative Number of Action Items by Severity Level – Cumulative number of action items submitted based on Severity levels, (i.e., Critical, High, Moderate, Low) • Total Number of Open Action Items – Total number of open action items as of the end of the reporting period • Total Number of Open Action Items by Severity Level – Total number of open action items by Severity level as of the end of the reporting period. • Cumulative Number of Closed Action Items – Cumulative number of action items that were closed during the reporting period. • Cumulative Number of Closed Action Items by Severity – Cumulative number of action items closed ordered by Severity level as of the end of the reporting period. • Action Item Aging – Used to ensure all Action Items are implemented in a timely manner. It is calculated by dividing the number of open action items by the number of closed action items. • Average Time Taken to Close Action Items – Total time to implement action item divided by the total number of closed action items. • Total Time Taken to Close Action Items – Sum the number of days from the date that the action item was opened until the day the action item was closed. • Cumulative Number of Open Action Items Based on Time Interval – Number of Action Items open 0-30 days, 31-60 days, 61-90 days, and > 90 days

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Item	Description
Name	Action Item Aging
	<ul style="list-style-type: none"> Cumulative Number of Action Items Open Per Severity and Time Interval – Number of Action Items open 0-30 days, 31–60 days, 61–90 days, and > 90 days using Critical, High, Intermediate, and Low Severity levels
Computation	See data items section above for computations
Interpretation	Action items that have been open for more than 30 days need to be followed up to ensure closure. Action items of greater severity may become potential risks that can affect cost and schedule.
Considerations	<ul style="list-style-type: none"> The ERA PMO will maintain the Action Item Database. The ERA PMO will review and approve the closure of all Action Items.
Example	<div style="text-align: center;">  <p data-bbox="786 1213 1149 1247">Action Item Aging Example</p> </div>
Data Source	Example includes an Action Item Database

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Item	Description
Name	Change Request Inventory
Program Goals	<ul style="list-style-type: none"> • Identify trends early in their life cycle in order to reduce, eliminate, or avoid cost and schedule implications. • Identify relationships between CRs and prevent perpetual CRs.
Questions	<ul style="list-style-type: none"> • What is the total number of change requests submitted? • What is the total number of change requests approved? • What is the total number of change requests disapproved? • What documents/software/hardware are impacted based on the required change? • What is the impact of the required change in terms of cost and schedule?
Impact	This metric can be used to alter or halt a project.
Target Value	N/A, there is no target value
Benefits	Enables the identification of trends that could have deleterious effects on cost, schedule, or performance.
Tools	Development Contractor Defined
Application	This metric lists the ERA change requests that are open as of the end of the reporting period, or those that have been approved or disapproved during the reporting period. The data provides management with insight to the trend in new change requests and resolution as the program progresses. This is a program management metric used to measure the rate of change in order to determine potential negative trends.
Data Items	<ul style="list-style-type: none"> • Change Request – A request for modification of ERA component (i.e., document, hardware, or software) made prior to the end of the reporting period. Includes Project, Release/Version Number, Date of Request, Type of Change, Priority, Status, and Date as specified in the CMP. • Total Number of Change Requests Submitted – Total number of change requests that were submitted for the reporting period. • Cumulative Number of Change Requests Submitted - Cumulative number of change requests submitted up through and including the reporting period. • Total Number of Change Requests Submitted by Type of Change – Total number of change requests that were submitted for the reporting period broken down by type of change, e.g., document, hardware, software, requirements. • Cumulative Number of Change Requests Submitted by Type of Change – Cumulative number of change requests by type of change that were submitted up through and including the reporting period. • Total Number of Change Requests Approved – Total number of change requests that were approved during the reporting period. • Cumulative Number of Change Requests Approved – Cumulative number of change requests that have been approved up through and

FINAL

Item	Description
Name	<p>Change Request Inventory</p> <p>including the reporting period.</p> <ul style="list-style-type: none"> • Total Number of Change Requests Open – Total number of change requests that have not been approved or disapproved as of the end of the reporting period. • Total Number of Change Requests Disapproved - Total number of change requests that were disapproved during the reporting period. • Cumulative Number of Change Requests Disapproved – Cumulative number of change requests that have been disapproved up through and including the reporting period. • Total Number of Change Requests Submitted by Priority - Total number of change requests that were submitted for the reporting period broken down by priority, i.e., Critical, High, Intermediate, or Low. • Cumulative Number of Change Requests Submitted by Priority – Cumulative number of change requests by priority that were submitted up through and including the reporting period. • Total Number of Change Requests Open by Type of Change – Total number of change requests open broken down by type of change for the reporting period. • Total Number of Change Requests Open by Priority – Total number of change requests open broken down by priority for the reporting period. • Cumulative Number of Change Requests Open by Priority- Cumulative number of Change Requests open by priority up through and including the reporting period. • Cumulative Number of Change Requests Open by Type of Change - Cumulative number of Change Requests open by type of change up through and including the reporting period. • Total Number of Change Requests Disapproved by Type of Change – Total number of change requests disapproved by type of change for the reporting period. • Cumulative Number of Change Requests Disapproved by Type of Change – Cumulative number of change requests disapproved by type of change up through and including the reporting period. • Cumulative Number of Change Requests Disapproved by Priority – Cumulative number of change requests disapproved by priority up through and including the reporting period. • Total Number of Change Requests Disapproved by Priority – Total number of change requests disapproved by priority for the reporting period. • Total Number of Change Requests Approved by Type of Change – Total number of Change Requests approved broken down by type of change for the reporting period.

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Item	Description
Name	Change Request Inventory
	<ul style="list-style-type: none"> • Cumulative Number of Change Requests Approved by Type of Change – Cumulative number of change requests approved broken down by type of change up through and including the reporting period. • Total Number of Change Requests Approved by Priority – Total number of Change Requests approved broken down by priority for the reporting period. • Cumulative Number of Change Requests Approved by Priority – Cumulative number of change requests approved broken priority up through and including the reporting period. • Total Number of Change Requests Approved for Inclusion in Current Release – Total number of change requests have been approved and will be included in the current release of software. • Total Number of Change Requests Approved for Inclusion in Next Release – Total number of change requests that have been approved for inclusion in the next software release. • Cost Impact – Cost of implementing the change. • Schedule Impact – Time added to the schedule due to implementing the changes.
Computation	Number of change requests submitted, approved, disapproved, approved for incorporation in next release as of the end of the reporting period.
Interpretation	A significant number of change request submittals can signal technical problems, lack of planning, or addition of new requirements, each of which could impact both cost and schedule.
Considerations	<ul style="list-style-type: none"> • ERA PMO will maintain all Change Requests. • ERA PMO will review and approve/disapprove all Change Requests. • All Change Requests will be submitted to the ERA PMO with as much information as possible including cost, schedule, and risk impacts.
Example	

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Item	Description																																																
Name	Change Request Inventory																																																
	<div data-bbox="646 363 1339 730" style="text-align: center;"> <table border="1" style="margin: 10px auto;"> <caption>Change Requests Inventory Data</caption> <thead> <tr> <th>Reporting Period</th> <th>Change Requests Opened</th> <th>Change Requests Approved</th> <th>Change Requests Disapproved</th> </tr> </thead> <tbody> <tr><td>Jun-02</td><td>2</td><td>2</td><td>0</td></tr> <tr><td>Jul-02</td><td>7</td><td>7</td><td>0</td></tr> <tr><td>Aug-02</td><td>4</td><td>4</td><td>0</td></tr> <tr><td>Sep-02</td><td>3</td><td>3</td><td>0</td></tr> <tr><td>Oct-02</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>Nov-02</td><td>5</td><td>3</td><td>0</td></tr> <tr><td>Dec-02</td><td>1</td><td>3</td><td>0</td></tr> <tr><td>Jan-03</td><td>6</td><td>6</td><td>0</td></tr> <tr><td>Feb-03</td><td>2</td><td>1</td><td>0</td></tr> <tr><td>Mar-03</td><td>5</td><td>6</td><td>0</td></tr> <tr><td>Apr-03</td><td>9</td><td>9</td><td>0</td></tr> </tbody> </table> <p>Change Request Inventory Example</p> </div>	Reporting Period	Change Requests Opened	Change Requests Approved	Change Requests Disapproved	Jun-02	2	2	0	Jul-02	7	7	0	Aug-02	4	4	0	Sep-02	3	3	0	Oct-02	0	0	0	Nov-02	5	3	0	Dec-02	1	3	0	Jan-03	6	6	0	Feb-03	2	1	0	Mar-03	5	6	0	Apr-03	9	9	0
Reporting Period	Change Requests Opened	Change Requests Approved	Change Requests Disapproved																																														
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Feb-03	2	1	0																																														
Mar-03	5	6	0																																														
Apr-03	9	9	0																																														
Data Source	Example includes a Change Request Tracking Database																																																

Item	Description
Name	Defect Management
Program Goals	<ul style="list-style-type: none"> • Monitor defects during development in order to avoid re-design that translates into performance, cost, and schedule impacts. • Monitor defects during test in order to determine the technical competency of the system.
Questions	<ul style="list-style-type: none"> • What is the total number of defects? • What is the total number of defects per Severity level? • Are the defects found concentrated in any one area? • What is the defect closure rate? • What is the impact to cost and schedule?
Impact	This metric can be used to alter or halt a project.
Target Value	N/A, there is no target value
Benefits	Enables the identification of trends that could have deleterious effects on cost, schedule, or performance.
Tools	Development Contractor Defined
Application	Tracks the persistence of software defects through the ERA life cycle to measure the effectiveness of development and verification activities. This is a program management metric used to identify and categorize defects that are found during development that may impact schedule, cost, and performance.
Data Items	<ul style="list-style-type: none"> • Defect - Any flaw in the specification, design, or in the coding, implementation, or testing of a work product which if not removed, would cause a program or system to fail or to produce incorrect results. Any occurrence in a work product that is determined to be incomplete or incorrect relative to the standards applicable for that work product. An

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Item	Description
Name	Defect Management
	<p>instance where the product does not meet a specified characteristic recorded as of the end of the reporting period.</p> <ul style="list-style-type: none"> • Total Number of Defects Found – Total number of all defects found during the reporting period. • Cumulative Number of Defects Found – Cumulative number of defects found during all reporting periods combined. • Total Number of Defects Found Per Defect Severity Level – Total number of defects found per severity level (i.e., Critical, High, Intermediate, or Low). • Percentage of Defects Found Per Severity Level – Calculated. Percentage of defects by severity level = number of defects for a severity level divided by total number of defects. X-axis = severity level, Y-axis = number or percentage of defects. • Total Number of Defects Found Per Origin (i.e., documentation, requirements, design, code, test, other (mistake in build/configuration process, development/integration tools, test environment)) - To see where most of the defects are coming from so that corrective action can be taken in those areas to reduce the number of defects. X-axis = defect origin or phase, Y-axis = number or percent of defects. • Total Number of Defects Found Per Type (e.g., computation, configuration files, data (incorrect record format, or missing records), database SQA script, functionality (not meeting a requirement), other (test tool problem, test set up is incorrect), hardware interface, logic, software interface) – Showing the number or percent of defects by defect type in order to see what kinds of defects most commonly occur so that corrective action can be taken in those areas to reduce the number of defects. Can depict either the number or percent of defects by origin. X-axis = defect type, Y-axis = number or percent of defects. • Total Number of Defects Closed – Total number of defects closed as of the end of the reporting period. • Cumulative Number of Defects Closed – Cumulative number of defects closed during all reporting periods combined. • Total Number of Defects Closed Per Severity Level – Total number of defects closed based on severity level. • Total Number of Defects Closed Per Origin– Total number of defects closed based on origin. • Total Number of Defects Closed Per Type – Total number of defects closed based on type. • Average Time to Fix Defect – Calculated. Used to forecast the time it will take to fix “x” number of defects which will be put in a certain release. Average time to fix a defect = Total time to fix each defect divided by the

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Item	Description
Name	Defect Management
	<p>total number of defects for which time to fix was entered.</p> <ul style="list-style-type: none"> • Defect Aging (by Severity) – Number or percentage of defects opened/closed. X-axis = time elapsed in months of age, Y-axis = number or percent of defects. Stacked bar chart on the X-axis to represent the number or percent of defects still open for each defect severity level. The purpose is to determine if there is a problem with critical and high severity defects taking a long time to fix. • Defect Detection/Removal Efficiency- This metric tracks the history of defect removal. Each defect should be corrected effectively, requiring only one re-inspection or regression test to verify removal. The data includes: <ul style="list-style-type: none"> – Total inspection to be conducted or tests to be run, – Inspections or test completed, and – Cumulative inspections or tests failed.
Computation	See Data Items Section
Interpretation	During the Development, and Operations and Support phases, the actual number of defects detected is tracked as well as the phase in which the defect was created. Examples include Requirements, Architecture, Design, Code, and Test Levels. These can be further sub-divided, e.g., defects found in an integration test could be broken down to the number of defects that are found per Configuration Item, etc.
Considerations	When analyzing defects, cost, schedule, and performance impacts will be provided.

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Item	Description																																																																								
Name	Defect Management																																																																								
Example	<p style="text-align: center;">Defects</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="2"></th> <th colspan="6" style="text-align: center;">Found In:</th> </tr> <tr> <th colspan="2"></th> <th style="writing-mode: vertical-rl; transform: rotate(180deg);">Requirements</th> <th style="writing-mode: vertical-rl; transform: rotate(180deg);">Architecture</th> <th style="writing-mode: vertical-rl; transform: rotate(180deg);">Design</th> <th style="writing-mode: vertical-rl; transform: rotate(180deg);">Code</th> <th style="writing-mode: vertical-rl; transform: rotate(180deg);">Test</th> <th style="writing-mode: vertical-rl; transform: rotate(180deg);">Total</th> </tr> </thead> <tbody> <tr> <th colspan="2" style="text-align: left;">Originated in:</th> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td style="text-align: left;">Requirements</td> <td></td> <td style="background-color: yellow;">22</td> <td>4</td> <td>8</td> <td>2</td> <td>12</td> <td>48</td> </tr> <tr> <td style="text-align: left;">Architecture</td> <td></td> <td>0</td> <td style="background-color: yellow;">17</td> <td>9</td> <td>2</td> <td>7</td> <td>35</td> </tr> <tr> <td style="text-align: left;">Design</td> <td></td> <td>0</td> <td>0</td> <td style="background-color: yellow;">12</td> <td>9</td> <td>5</td> <td>26</td> </tr> <tr> <td style="text-align: left;">Code</td> <td></td> <td>0</td> <td>0</td> <td>0</td> <td style="background-color: yellow;">7</td> <td>16</td> <td>23</td> </tr> <tr> <td style="text-align: left;">Test</td> <td></td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td style="background-color: yellow;">28</td> <td>28</td> </tr> <tr> <td style="text-align: left;">Total</td> <td></td> <td>22</td> <td>21</td> <td>29</td> <td>20</td> <td>85</td> <td></td> </tr> </tbody> </table>			Found In:								Requirements	Architecture	Design	Code	Test	Total	Originated in:								Requirements		22	4	8	2	12	48	Architecture		0	17	9	2	7	35	Design		0	0	12	9	5	26	Code		0	0	0	7	16	23	Test		0	0	0	0	28	28	Total		22	21	29	20	85	
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Item	Description
Name	Defect Management
	Defect Management Example
Data Source	Example includes a Defect Tracking Database

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Item	Description
Name	Earned Value Management
Program Goals	<ul style="list-style-type: none"> • Monitor performance, cost, and schedule using a timeline • Monitor the schedule and completion of work products relative to their scheduled and actual completion times • Ensure the project has sufficient resources • Determine how much of the planned work has been done • Forecast the final spending and completion date • Provide an early warning when the project starts to go off-track • Discover which areas/tasks are causing the problems, and where anomalies are occurring • Demonstrate and keep the project/development under control • Track total number of hours per task (cumulative), both budgeted and actual during the reporting period • Track total number of hours spent to complete a task
Questions	<ul style="list-style-type: none"> • How is the project performing with respect to cost? • How is the project performing with respect to schedule? • Is the work force sufficient to complete the work and how well are they performing? • What are the staffing levels: Actual, Planned, Variance? • Is the correct labor mix being used? • Is project performance increasing? • How much work/how many tasks has/have been completed as compared to the plan? • Will the project complete on time? • Is scheduled work being completed on time? • Is scheduled work being completed within cost parameters? • Is the total number of hours (actual) spent working on a task more than the budgeted amount? • Is a pattern emerging where it is taking longer than planned to complete particular tasks? • Is the overrun of hours required to complete a task in a particular component area? • Was the prepared budget inadequate for the amount of work to be performed? • Is the component area more technically challenging than originally anticipated?
Impact	<p>These metrics can be used to monitor progress, provide early warnings of problems, trends, enable process improvement, and enable decision making whether to continue work on the project.</p>
Target Value	<ul style="list-style-type: none"> • Using EVMS, no credit is given unless milestones are one hundred percent complete. • Cost Performance Index (CPI) <1.00 indicates potential productivity problem

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Item	Description
Name	Earned Value Management
	<ul style="list-style-type: none"> • Level Of Effort (LOE) > 100% of planned effort required to complete activity - If the cumulative actual labor hours exceed cumulative budgeted hours to complete a task(s), this could be indicative of poor estimation and planning, and leading to overruns and shortening of the test cycle to get back on schedule. • LOE could also be an indication of the wrong level of labor mix.
Benefits	<ul style="list-style-type: none"> • CPI shows how efficiently the team has turned costs into progress to date CPI represents how much work was performed for each dollar spent. • Schedule Performance Index (SPI) establishes the performance baseline against which the program can compare actual performance data. • Reviewing for potential threats • Timeliness of accurate (realtime) data providing ample time to act
Tools	Development Contractor Defined
Application	<ul style="list-style-type: none"> • This is a program management metric used to monitor cost, performance, and schedule. • The SPI compares performance to the schedule. The indices of CPI and SPI are the standard cost and schedule performance measures for both government and industry. The CPI shows how efficiently the team has turned costs into progress to date CPI represents how much work was performed for each dollar spent. • The primary report used for analysis of performance in an EVMS system is the cost/schedule status report and it includes PV, AC, EV, and EAC in addition to calculated cost and schedule variance for each WBS element from the cost account level up to the project level. • VARs provide current period, cumulative, and at-completion data. VAR contains a description of the cause of the variance, its impact on the project including other elements of the project, corrective action to be taken, and follow-up on previous action taken. Variance thresholds may be reported as a percentage, dollar amount, or a combination of the two.
Data Items	<ul style="list-style-type: none"> • Budget At Completion (BAC) - The total value assigned to the program and, if all goes as planned, the total cost. The planned value accounts for all direct and indirect labor (expressed in dollars) that the work is expected to cost. • Planned Value (PV) – The sum of budgets allocated to time-phased elements of work (Work Packages (WP)) on the program; the planned value. • Earned Value (EV) – The budgeted cost of work recorded when the work is actually completed; earned value. • Actual Cost (AC) – The actual, not the estimated, cost of the work performed to-date. • Task - The lowest level of effort in the ERA program schedule. • Cumulative Budgeted Labor Hours - Total number of hours to be worked on a task through the end of the reporting period as defined in the contract. Includes Task Name and Task Cumulative Estimated Labor Hours. • Total Budgeted Labor Hours - Total number of hours to be expended to

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Item	Description
Name	Earned Value Management
	<p>complete a task as defined in the contract. Includes Task Name and Task Total Estimated Labor Hours.</p> <ul style="list-style-type: none"> • Cumulative Actual Labor Hours - Total number of hours spent working on a task through the end of the reporting period. Includes Task Name, Task Cumulative Estimated Labor Hours, Task Actual Labor Hours, and Task Cumulative Actual Labor Hours.
Computations	<ul style="list-style-type: none"> • Estimate at Completion (EAC) = This formula determines the unfinished or unearned work given by the formula. $\text{Estimate at Completion (EAC)} = \frac{\text{BAC}}{\text{CPI}}$ A poor performance, or CPI less than 1, results in an EAC that is greater than the BAC • Variance at Completion (VAC) = The difference between the EAC and the BAC given by the following formula: $\text{Variance at Completion (VAC)} = \text{EAC} - \text{BAC}$ When the projected final cost exceeds the budget, the Development Contractor is effectively predicting an overrun, termed an Adverse Variance at Completion. • Cost Variance (CV) = The difference between EV and AC given by the formula: $\text{Cost Variance} = \text{EV} - \text{AC}$ OR $\text{Cost Variance Percentage} = \frac{\text{CV}}{\text{EV}} \times 100$

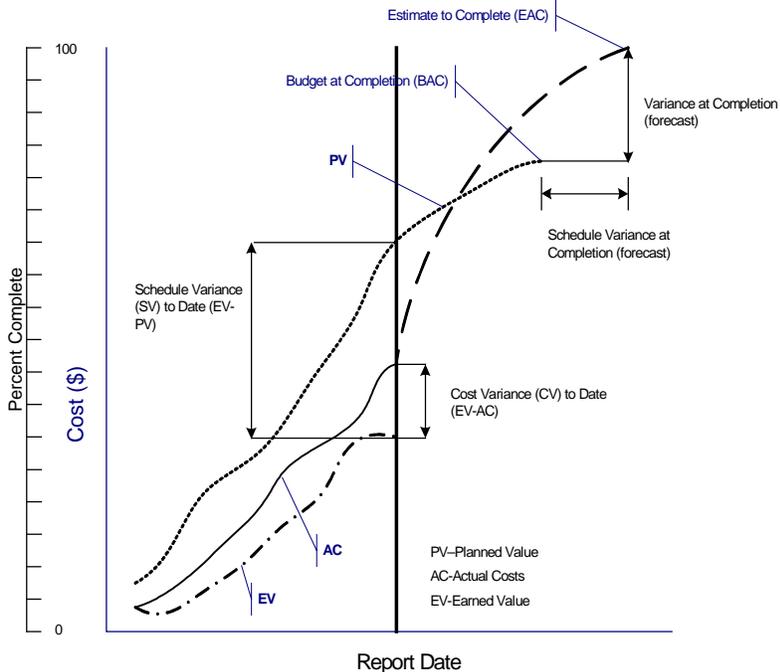
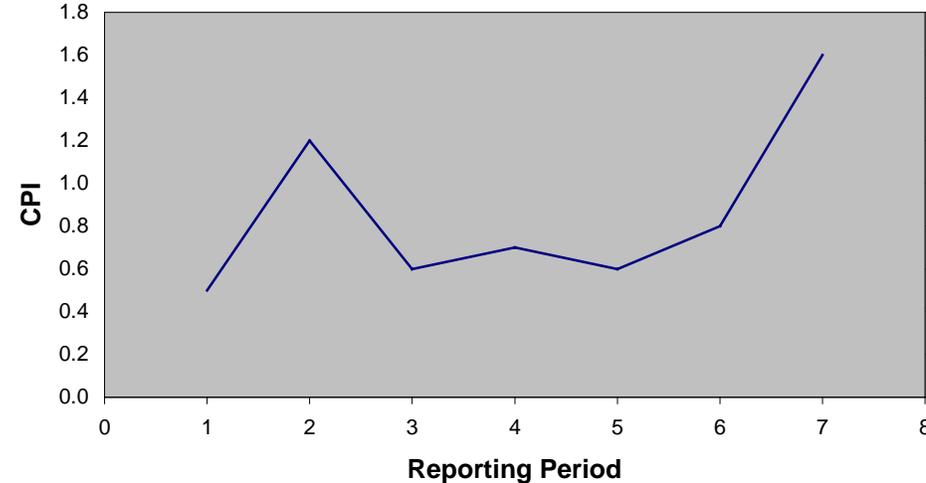
Item	Description
Name	<p>Earned Value Management</p> <ul style="list-style-type: none"> <p>Schedule Variance (SV) = The difference between EV and PV given by the formula:</p> $\text{Schedule Variance} = \text{EV} - \text{PV}$ <p>Or</p> $\text{Schedule Variance Percentage} = \frac{\text{SV}}{\text{PV}} \times 100$ <p>Schedule Performance Index (SPI) = EV divided by PV as given by the formula:</p> $\text{Schedule Performance Index} = \frac{\text{EV}}{\text{PV}}$ <p>Cost Performance Index (CPI) = EV divided by the AC given by the formula:</p> $\text{Cost Performance Index} = \frac{\text{EV}}{\text{AC}}$ <p>A CPI of less than a 1.0 indicates potential productivity problem</p> <p>Variance At Completion (VAC) =</p> $\text{Variance at Completion (VAC)} = \text{BAC} - \text{EAC}$ <p>To Complete Performance Index (TCPI) shows the future projection of the average productivity needed to complete the program within an estimated budget. It is calculated by the following formula:</p>

FINAL

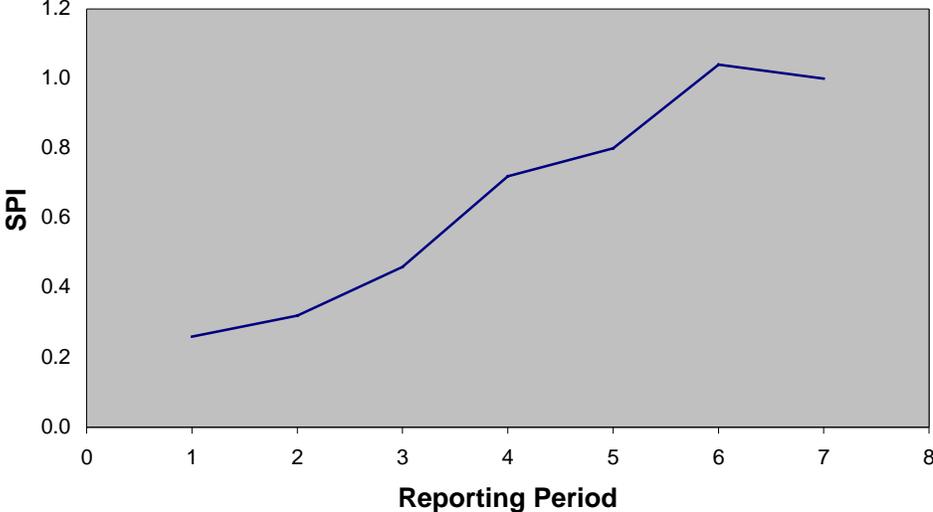
Item	Description
Name	Earned Value Management
	<p style="text-align: right;"> Work Remaining BAC – EV ----- = ----- Money Remaining BAC – AC </p> <p style="text-align: right;"> To Complete Performance Index (BAC) = </p> <p style="text-align: right;"> Work Remaining BAC – EV ----- = ----- Money Remaining EAC – AC </p> <p style="text-align: right;"> To Complete Performance Index (EAC) = </p> <ul style="list-style-type: none"> • Estimate at Completion (EAC) = The difference between the Estimate at Completion and Actual Cost given by the formula: $\text{Estimate at Completion (EAC)} = \frac{\text{BAC}}{\text{CPI}}$
Interpretation	<ul style="list-style-type: none"> • The closer the CPI and SPI are to a value of 1.00, the more successful the program can be considered, at least in terms of cost and schedule. • >5% LOE may present problems when trying to measure project performance. • TCPI is compared with CPI to determine how realistic the most recent Estimate at Completion (EAC) is for the program. If TCPI is greater than CPI ($CPI/TCPI < 1$), the team is anticipating an efficiency improvement. The estimated total cost of the program (EAC) can therefore be calibrated by comparing TCPI with CPI. If TCPI is 20 percent above the current value of the CPI, both indices require closer examination. • Can apply the metric to detect: <ul style="list-style-type: none"> – Schedule slippage – Lack of resources to complete the tasks – Task completion is low as compared to the plan, i.e., reduced efficiency – Cost of work performed is greater than Earned Value
Considerations	<ul style="list-style-type: none"> • In order to use the metrics the program/project must: <ul style="list-style-type: none"> – Have produced a WBS – Have produced a logical and Resource Baseline Plan/Resource Loaded Network – Have separated the total budget into effort (labor-hours) and material costs – Have allocated the effort element amongst all of the tasks using best estimating techniques – Record the effort spent on each task (planned versus actual) – Re-forecast the effort required to complete each task every month (need input each month) – Decide how to divide up the work for Metrics Reporting • Effort requires due diligence in order to correctly use EVMS and maximize the benefits (of collecting and reporting the metric for decision making) and data needs to be timely and current

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Item	Description
Name	Earned Value Management
	<ul style="list-style-type: none">• Quantify LOE in order to establish a viable baseline, i.e., the Project Manager must know how much LOE is in the baseline.• Keep all LOE in a single bucket never co-mingling it with discrete work.• If LOE is skewed to the left, toward the front-end of the baseline, then it may distort performance.• LOE has been criticized because it does not measure performance but rather measures the passage of time, i.e., with LOE, work does not have to be performed. The Planned Value merely must have a value, and Earned Value performance will equate to the plan. LOE may mask serious problems in project performance because positive LOE performance will offset negative discrete results. To avoid this, the amount of LOE work must be quantified; LOE should always be kept in “one bucket” and not co-mingle LOE with discretely measured work in order to allow for the accurate measurement of performance to the project baseline.• To prepare ETC, the following items should be considered:<ul style="list-style-type: none">– Cumulative AC divided by ordered commitments– Schedule status– EV to-date– Remaining scope of work– Previous ETC– Historical data,– Required resources by type– Projected cost and schedule efficiency improvement,– Future actions– Approved contract changes

Item	Description
Name	Earned Value Management
Example	 <p style="text-align: center;">EVMS Example</p>  <p style="text-align: center;">Cost Performance Index Example</p>

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Item	Description																
Name	Earned Value Management																
	 <p data-bbox="816 961 1187 993">Schedule Performance Index</p> <table border="1" data-bbox="492 365 1425 877"><caption>Schedule Performance Index Data</caption><thead><tr><th>Reporting Period</th><th>SPI</th></tr></thead><tbody><tr><td>1</td><td>0.26</td></tr><tr><td>2</td><td>0.32</td></tr><tr><td>3</td><td>0.46</td></tr><tr><td>4</td><td>0.72</td></tr><tr><td>5</td><td>0.80</td></tr><tr><td>6</td><td>1.04</td></tr><tr><td>7</td><td>1.00</td></tr></tbody></table>	Reporting Period	SPI	1	0.26	2	0.32	3	0.46	4	0.72	5	0.80	6	1.04	7	1.00
Reporting Period	SPI																
1	0.26																
2	0.32																
3	0.46																
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5	0.80																
6	1.04																
7	1.00																

FINAL

Item	Description
Name	Earned Value Management
	<p style="text-align: center;">To Complete Performance Index Example</p>
Data Source	Examples include MS Excel and MS Project Scheduler

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Item	Description
Name	Risk Containment Summary
Program Goals	<ul style="list-style-type: none"> • Track risks by risk exposure • Identify trends • Develop risk strategies to mitigate, reduce, or eliminate potential risks
Questions	<ul style="list-style-type: none"> • What is the total number of risks that have been identified? • What is the total number of high exposure risks? • What is the total number of moderate exposure risks? • What is the total number of low exposure risks?
Impact	Can be used to halt or alter the project depending on the severity of the risk.
Target Value	None
Benefits	This measure provides a useful summary for management to identify trends in risk identification in order to be able to monitor them and to also develop strategies to mitigate, reduce, or eliminate them.
Tools	Development Contractor Defined
Application	The metric is a program management metric used to monitor all risk items.
Data Items	<ul style="list-style-type: none"> • Cumulative Number of Open Risk Items – Cumulative number of open risk items up to and including the reporting period. • Cumulative Number of Open Risk Items by Risk Exposure (i.e., High, Moderate, Low) – Total number of open risk items by risk exposure level that are open as of the end of the reporting period. <ul style="list-style-type: none"> – High Exposure - Risks that have a significant impact on cost, schedule, or performance. Significant action required. – Moderate Exposure - Risks that have some impact. Special action may be required. Additional management attention may be required. – Low Exposure - Risks that have minimum impact. Normal oversight needed to ensure risk remains low. • Cumulative Number of Closed Risk Items – Total number of closed risk items by risk exposure level that have been closed for the reporting period. • Cumulative Number of Closed Risk Items by Exposure Level – Total number of closed risk items by risk exposure level that have been closed as of the end of the reporting period.

FINAL

Item	Description
------	-------------

Name

Risk Containment Summary

Computation

Risk Exposure is determined using: Impact multiplied by Likelihood/Probability.

 Risk Impact Level and Likelihood/Probability are determined using the following:

<i>Level</i>	<i>Technical Performance</i>	<i>Schedule</i>	<i>Cost</i>	<i>Impact on Other Teams</i>
1	Minimal or no Impact	Minimal or No Impact.	Minimal or no Impact	None
2	Acceptable with some reduction in margin	Additional resources required. Able to meet need dates.	<5%	Some impact
3	Acceptable with significant reduction in margin	Minor slip in key milestone. Not able to meet need dates.	5 – 7%	Moderate impact
4	Acceptable – no remaining margin	Major slip in key milestone or critical path impacted.	>7<10%	Major impact
5	Unacceptable	Can't achieve key team or major program milestone.	>10%	Unacceptable

Risk Impact Chart Example

FINAL

Item	Description																																						
Name	Risk Containment Summary																																						
Interpretation	Less than a 95% completion rate could infer a schedule slip is imminent.																																						
Considerations	The data is appropriate for this metric as it is an indicator of development progress toward meeting scheduled milestones.																																						
Example	<div style="text-align: center;"> <table border="1" data-bbox="657 1087 1446 1514"> <tr> <td></td> <td style="background-color: cyan;">5</td> <td style="background-color: yellow;"></td> <td style="background-color: yellow;"></td> <td style="background-color: red;"></td> <td style="background-color: red;"></td> <td style="background-color: red;">1</td> </tr> <tr> <td rowspan="5" style="vertical-align: middle;">Impact</td> <td style="background-color: cyan;">4</td> <td style="background-color: green;"></td> <td style="background-color: yellow;"></td> <td style="background-color: yellow;"></td> <td style="background-color: red;">3</td> <td style="background-color: red;"></td> </tr> <tr> <td style="background-color: cyan;">3</td> <td style="background-color: green;"></td> <td style="background-color: yellow;">2</td> <td style="background-color: yellow;">4</td> <td style="background-color: red;"></td> <td style="background-color: red;"></td> </tr> <tr> <td style="background-color: cyan;">2</td> <td style="background-color: green;">3</td> <td style="background-color: green;">1</td> <td style="background-color: yellow;"></td> <td style="background-color: yellow;"></td> <td style="background-color: yellow;"></td> </tr> <tr> <td style="background-color: cyan;">1</td> <td style="background-color: green;">2</td> <td style="background-color: green;">4</td> <td style="background-color: green;"></td> <td style="background-color: green;"></td> <td style="background-color: green;"></td> </tr> <tr> <td style="background-color: cyan;"></td> <td style="background-color: cyan;">1 - 20</td> <td style="background-color: cyan;">21 - 40</td> <td style="background-color: cyan;">41 - 60</td> <td style="background-color: cyan;">61 - 80</td> <td style="background-color: cyan;">81 - 99</td> </tr> </table> <p data-bbox="917 1528 1187 1556">Likelihood /Probability (%)</p> <p data-bbox="467 1682 574 1717">Legend:</p> </div>		5					1	Impact	4				3		3		2	4			2	3	1				1	2	4					1 - 20	21 - 40	41 - 60	61 - 80	81 - 99
	5					1																																	
Impact	4				3																																		
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Item	Description								
Name	Risk Containment Summary								
	<table border="1"><tr><td data-bbox="467 331 602 359">High Exposure</td><td data-bbox="602 331 1466 359">High Exposure</td></tr><tr><td data-bbox="467 359 602 386">Moderate Exposure</td><td data-bbox="602 359 1466 386">Moderate Exposure</td></tr><tr><td data-bbox="467 386 602 413">Low Exposure</td><td data-bbox="602 386 1466 413">Low Exposure</td></tr><tr><td data-bbox="467 413 602 441">#</td><td data-bbox="602 413 1466 441"># = number of risks in that impact/probability bin</td></tr></table> <p data-bbox="792 472 1144 506">Risk Containment Example</p>	High Exposure	High Exposure	Moderate Exposure	Moderate Exposure	Low Exposure	Low Exposure	#	# = number of risks in that impact/probability bin
High Exposure	High Exposure								
Moderate Exposure	Moderate Exposure								
Low Exposure	Low Exposure								
#	# = number of risks in that impact/probability bin								
Data Source	Examples include Risk Radar and MS Access								

FINAL

Item	Description
Name	Software Size
Program Goals	<ul style="list-style-type: none"> • Monitor the size of the software including Software Lines of Code (SLOC) that includes reused code in order to determine growth of the system as compared to the initial software estimate. • Monitor the size of the software to determine the affect (if any) on memory requirements and system load requirements.
Questions	<ul style="list-style-type: none"> • Is there substantial growth in any one component area? What component? • What is the engineering reasoning being provided for the unanticipated growth? • If software size is larger than anticipated, what is the affect on the system? • What is the impact to schedule and cost as a result of an increase in software size?
Impact	This metric cannot be used to alter or halt a project.
Target Value	None
Benefits	<ul style="list-style-type: none"> • Provides insight as to the accuracy of the original estimates as well as the level of effort required for completion. • Provides insight into potential schedule slippage due to additional development. • This metric provides data regarding the rate of code development and includes only SLOC placed under CM. The metric shows the completeness of the software product and the life cycle process.
Tools	Development Contractor Defined
Application	Software Size is a performance metric used to reflect the growth from the original size of the software to the current actual size.
Data Items	<ul style="list-style-type: none"> • Software Lines of Code (SLOC) - Count of the actual number of lines of code developed and unit tested. • Software Lines of Code (SLOC) CM Actual - Count of the actual number of lines of code developed and unit tested. • Estimated SLOC - The total SLOC planned to be placed under CM by the end of the reporting period according to the program schedule. Includes SLOC CM Estimated Total and SLOC CM Scheduled Finish Date. • SLOC Under CM - Actual SLOC placed under CM during the reporting period. Includes SLOC CM Estimated Total, SLOC CM Scheduled Finished Date, SLOC CM Actual Total, and SLOC CM Actual Finish Data.
Computation	Summation/count of the lines of code based on the descriptions in the Data Section above.

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Item	Description
Name	Software Size
Interpretation	<ul style="list-style-type: none"> • Unanticipated growth could have schedule and cost implications. • Unanticipated growth could be the result of poor requirement definition and/or understanding. • Unanticipated growth could be the result of poor estimation due to lack of similar systems in which to base the estimate/effort on.
Considerations	Need to identify and establish what a line of code constitutes, e.g., is a commented line considered to be a line of code, or must it be executable to be considered to be a line of code?
Example	<div data-bbox="472 642 1433 1052" style="text-align: center;"> <p>Development Productivity</p> <p>Software Development Productivity Example</p> </div> <div data-bbox="529 1157 1409 1730" style="text-align: center;"> <p>Software Size Example</p> </div>
Data Source	Example includes Software Lifecycle Management (SLIM)

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Item	Description
Name	Test Coverage
Program Goals	<ul style="list-style-type: none"> • Monitor test progress to determine stability of the design. • Monitor test progress in regard to overall schedule.
Questions	<ul style="list-style-type: none"> • How many test cases have been scheduled? • What is the Pass/Fail status of the tests that have been executed? • What is the percentage of tests passed? Tests failed? • How many defects have been identified?
Impact	Failure of numerous tests may result in a schedule slip or redesign thus altering the project.
Target Value	When the number of test plans completed is less than the number planned by a significant amount, it can be inferred that a schedule slip is imminent unless improvements are made in the completion of testing efforts.
Benefits	Lack of test completion/numerous defects found could be a sign of an unstable design that could lead to schedule slips.
Tools	Development Contractor Defined
Application	Test coverage is a performance metric that is used to measure product quality.
Data Items	<ul style="list-style-type: none"> • Total Number of Tests/Test Cases Scheduled – Sum of tests from test schedule/plan. Used in calculating percentage of tests executed. • Total Number of Tests/Test Cases Executed – Sum of number of tests with status = executed. Used in calculating percentages of tests executed, passed, and failed. • Percentage of Tests Executed – Calculated. Divide number of tests executed by the number of tests scheduled and multiply result by 100. Used to quantify how complete testing is. • Total Number of Tests/Test Cases Passed – Sum of number of tests with status = passed. Used in calculating the percentage of tests passed. • Percentage of Tests Passed – Calculated. Divide the number of tests passed by the number of tests executed and multiply result by 100. Used to quantify the quality of the system being tested. • Total Number of Tests Failed – Sum of number of tests with status = failed. Used in calculating the percentage of tests failed. • Percentage of Tests Failed – Calculated. Divide the number of tests failed by the number of tests executed multiplying the result by 100. Used to quantify the quality of the system being tested. • Total time spent fixing defects found in testing – Sum of corresponding field for all records. Used in calculating average time to fix a defect found in testing. • Number and percentage of defects found in testing (total and by severity type) – Sum the number of defects. Used in the calculating average time to fix a defect found in testing. The number of “undecided” severity

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Item	Description
Name	<p>Test Coverage</p> <p>should be tracked until a severity is assigned. Severity types include:</p> <ul style="list-style-type: none"> – Critical – A severe defect with no workaround, e.g., system crash. Issues that prevent a user from running the application or a module in the application. – High – A severe or significant defect. No workaround exists for this function, but other coded functions can be used. – Intermediate – A defect that is more of an inconvenience, e.g., a drop down list sorted incorrectly but contained all of the required information; a workaround exists. – Low – A minor defect that does not affect performance. <ul style="list-style-type: none"> • Phase Detected In – Unit Test, Integration Test, System Test, or Acceptance Test • Average time spent fixing a defect in testing – Calculated. Divide the total time spent fixing defects found in testing by the total number of defects found in testing.
Computation	<p>Execution Failure rate is used to determine the effectiveness of the testing effort as given by the formula:</p> $\text{Execution Failure Rate} = \frac{\text{Number of Failed Tests}}{\text{Total Number of Tests}} \times 100$ <p>Percentage of tests executed is used to quantify how complete testing is given by the formula:</p> $\text{Percentage Tests Executed} = \frac{\text{Number of Tests Executed}}{\text{Number of Tests Scheduled}} \times 100$ <p>Percentage of tests passed is used to quantify the quality of the system under test and is given by the formula:</p>

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Item	Description
Name	<p>Test Coverage</p> $\text{Percentage Tests Passed} = \frac{\text{Number of Tests Passed}}{\text{Number of Tests Executed}} \times 100$ <p>Percentage of tests failed is used to quantify the quality of the system under test and is given by the formula:</p> $\text{Percentage Tests Failed} = \frac{\text{Number of Tests Failed}}{\text{Number of Tests Executed}} \times 100$ <p>Average time spent fixing a defect in testing is used to quantify how much time has been spent on fixing defects that have been found during testing and is given by the formula:</p> $\text{Average time spent fixing a defect in testing} = \frac{\text{Total Time Fixing Defects}}{\text{Total Number Defects}} \times 100$
Interpretation	See Data Items Section above
Considerations	When documenting test defects, data will include cost, schedule, and performance impacts.

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Item	Description												
Name	Test Coverage												
Example	<div data-bbox="609 898 1414 1346" style="text-align: center;"> <p>System Test Results Summary</p> <table border="1"> <caption>Data for System Test Results Summary</caption> <thead> <tr> <th>Test Category</th> <th>Number of Tests</th> </tr> </thead> <tbody> <tr> <td>Scheduled</td> <td>50</td> </tr> <tr> <td>Executed</td> <td>48</td> </tr> <tr> <td>Awaiting Execution</td> <td>2</td> </tr> <tr> <td>Passed</td> <td>40</td> </tr> <tr> <td>Failed</td> <td>8</td> </tr> </tbody> </table> </div> <p data-bbox="797 1356 1133 1392">Test Case Status Example</p>	Test Category	Number of Tests	Scheduled	50	Executed	48	Awaiting Execution	2	Passed	40	Failed	8
Test Category	Number of Tests												
Scheduled	50												
Executed	48												
Awaiting Execution	2												
Passed	40												
Failed	8												
Data Source	Examples include Test Data Sheets, Raw Data, and Test Database												